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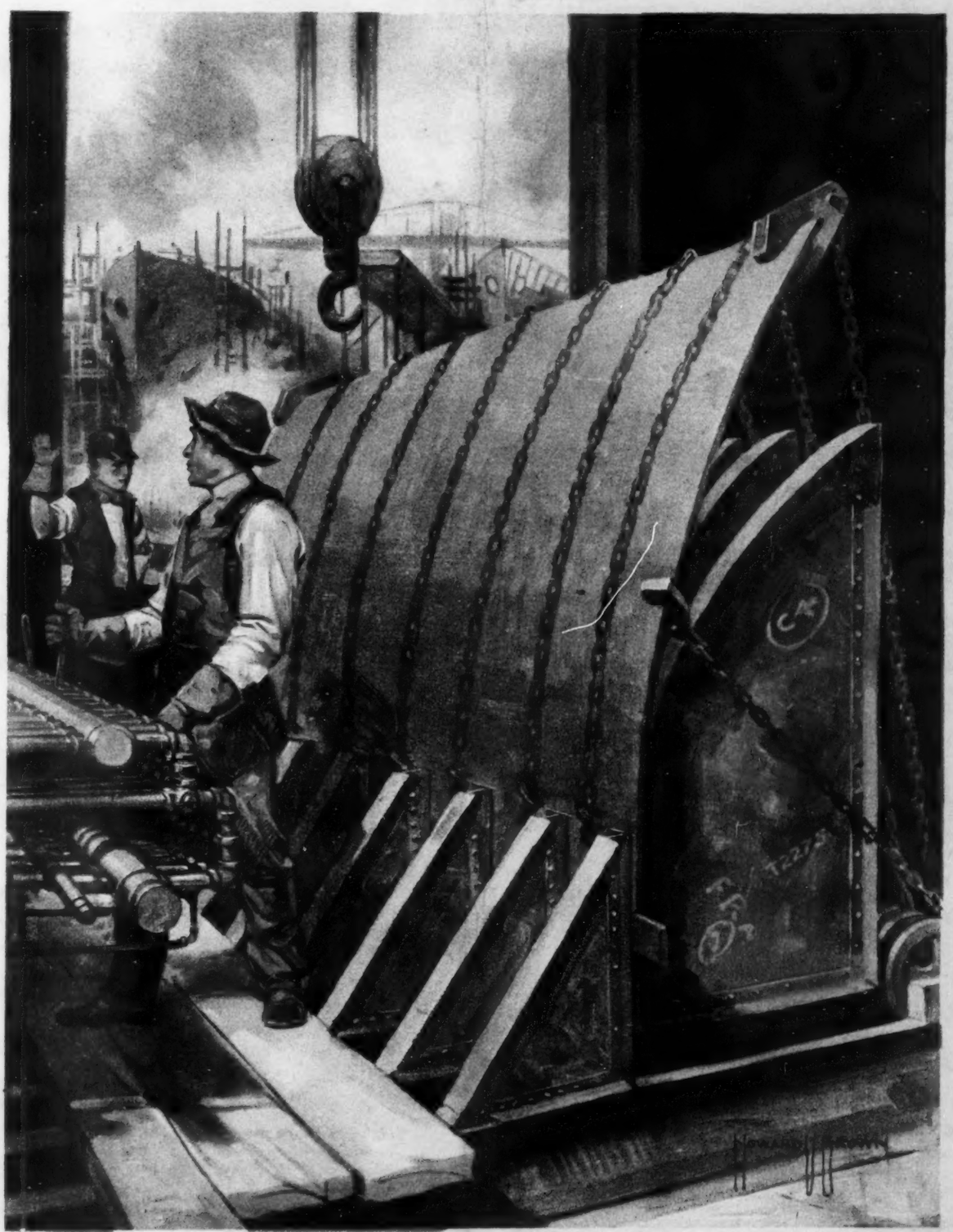

COLD BENDING OF SHIP PLATES IN A PENSACOLA YARD [See page 119]

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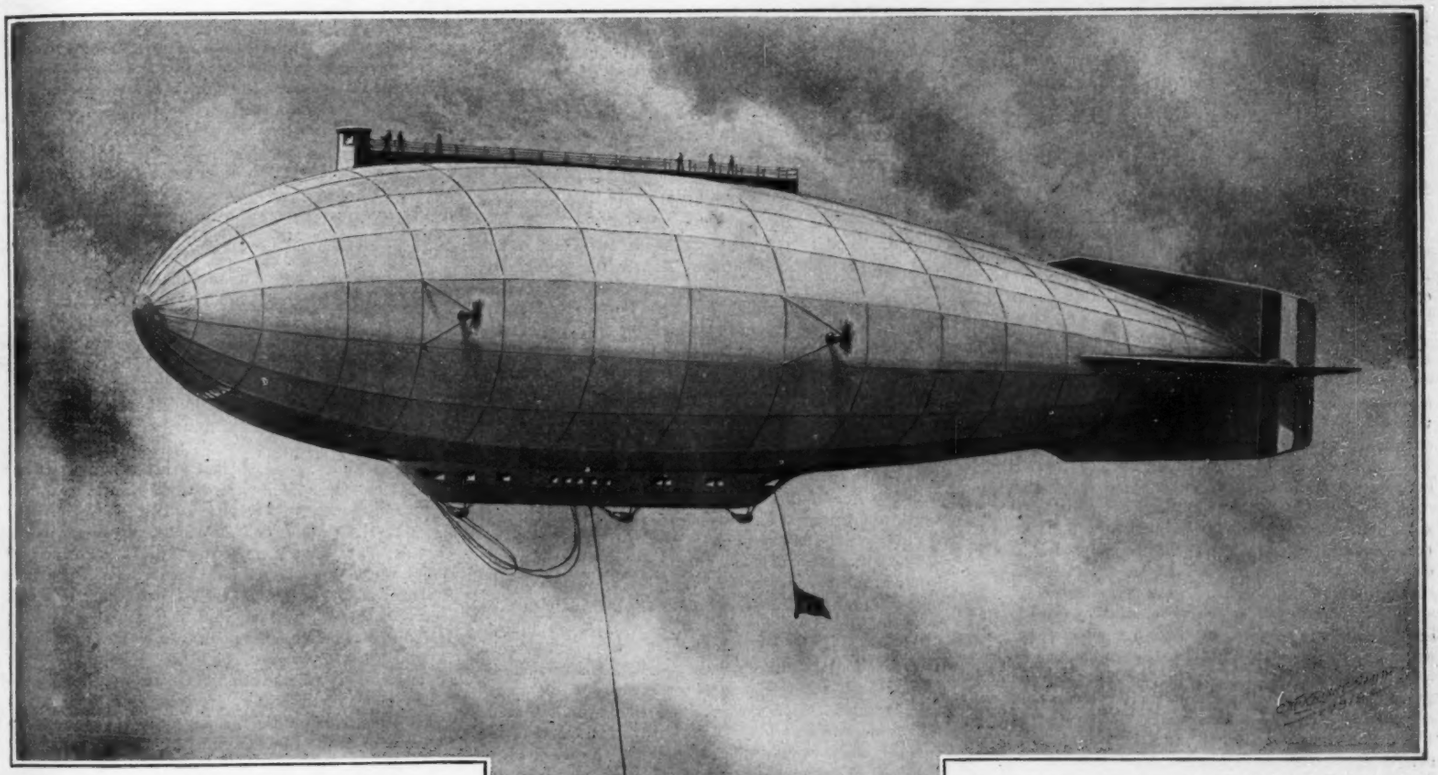

Launching an Airplane from an Airship

BY no means new is the idea of launching an airplane from an airship. For many years past artists have shown large dirigibles carrying one or more airplanes, for military and peaceful purposes. But it is one thing merely to confine such ideas to paper and quite another to realize such an achievement; and it is in the latter category that the accompanying illustration falls. It is based on actuality.

Several weeks ago the experiment of launching an airplane from a dirigible was successfully carried out at the Rockaway Beach air station of the Navy, near New York city. One of the large Naval airships was brought to the field and landed followed by five airplanes from the Mineola air school. When preparations for the test had been completed, the airship rose to a height of 100 feet, held by its anchor ropes, while one of the airplanes was wheeled into position below the large gas bag. The airplane was fastened to the dirigible by means of a 100-foot cable, dropped from the car of the latter.

These preparations completed, ballast was dropped from the dirigible. The airship rapidly rose to 3,000 feet, with the diminutive airplane swinging below it at the end of the 100-foot cable. At the proper moment the airplane pilot pulled the release cord and freed his machine, which, with the engine "dead," went into a steep nose dive.

The force of the air in the downward rush was counted upon to crank the propeller and engine. After dropping about 1,000 feet, the engine started with a roar, and the pilot then rejoined the four other airplanes which had been circling about, and in their company started off for the Mineola field.

The airship was piloted by Lieut. George Crompton of the Naval Flying Corps, with Chief Machinist Mates J. L. Nichols and G. Cooper as crew. Lieut. A. W. Redfield volunteered as pilot for the airplane. As far as is known, this is the first successful experiment of its kind.

Method of attaching airplane to a helium airship of the near future

Dynamiting Devastated Orchards in France

AN interesting new method for the rehabilitation of the French orchards devastated by the enemy was recently laid before the French Academy by its author, M. André Piédallu. The process consists essentially in using dynamite for the double purpose of breaking up the earth and securing an intimate mixture of the required fertilizers with it. The author had noticed the specially vigorous development of wild plants around the edges of old shell holes and old trenches which had suffered from heavy firing. He attributed this vigor of growth partly to the fissuration of the soil and partly to its impregnation with nitrogenous subjects. This view was supported by some experiments made several years ago in the western part of the United States, in which two-year-old cherry trees planted in holes excavated by dynamite reached the height of three meters (about 10 feet), while similar specimens planted by a spade remained spindling and grew scarcely half as tall.

M. Piédallu applied his idea by placing a suitable amount of fertilizer in a container surrounding the explosives, in such a way that the force of the explosion would drive the former into the minute cracks produced, thus forming an ideal medium for the growth of the young tree. The formula of the explosive is not given, but it is stated that it is not affected either by concussion or dampness, is capable of being molded, is completely free from chlorates (which might injure vegetation), is highly energetic in small volumes, and cannot be detonated except by a fulminating cap. The fertilizers employed are chosen with special reference to the character of the earth and the needs of the trees to be planted.

The compressed fertilizer molded around a nucleus of the explosive is placed in the bottom of a tube of celluloid, paper or cardboard. The cylinder of explosive, which contains a cavity for the fulminating charge, is then placed in the top of the tube, the hole being closed by a stopper pierced by a hole through which passes (fitting tightly) a piece of Bickford cord connected with the cap. Both the explosive charge and the mass of fertilizer adjoining it are covered with paraffin. The application of the charge is very simple and is said to save both time and labor. A hole like one used for placing a mine is bored with a pointed stick or iron rod, somewhat larger in diameter than the cartridge. This hole should be 60 centimetres deep (about 2 feet).

The explosion produces a spheroidal cavity some 80 centimetres in depth (about 30 inches). The earth absorbs the vapors liberated and the young tree is then placed in the hole and its roots covered with the earth.

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The object of this journal is to record accurately and lucidly the latest scientific, mechanical and industrial news of the day. As a weekly journal, it is in a position to announce interesting developments before they are published elsewhere.

The Editor is glad to have submitted to him timely articles suitable for these columns, especially when such articles are accompanied by photographs.

A Solution of the Railroad Problem

THE operation of our railroads by the Government has taught us certain lessons as to the practical value of coöperation, which should form the basis of any new system of control that may be adopted. Having said that, we wish to go on record as being opposed to complete governmental ownership and control of the railroads.

A business organization that employs 2,000,000 men and upon which, therefore, 10,000,000, or ten per cent of our population, is dependent for a living is a mighty factor in determining the national prosperity. When we remember that it was transportation, moving over our vast network of railroads, that opened up these United States and brought them to their present high stage of development, it will be admitted that the question of making any such radical departure as that of a permanent or even lengthy change from private to governmental operation, should be approached with the greatest restraint and weighed in the scales of calm business judgment based on past experience.

The issue is between governmental ownership and operation and private ownership under reasonable direction and control by the Government; and we believe that the safe way out of the present difficulties lies in a whole-hearted adoption, by the Government and the people, of the second alternative.

It is American initiative and the competitive spirit that have made the agricultural, mechanical and industrial development of the United States the wonder and admiration of the world. Therefore we should be very slow to make any change that might curtail initiative and we should set our face like adamant against any sweeping change that would kill it.

We do not know of anything that would, and does, so quickly and completely kill initiative as governmental ownership and control.

The railroads cannot have too much initiative. But past experience has shown that they may have too much competition; and the great lesson taught by the operation of the roads under Director-General McAdoo is that the great need of the future is a reasonable and well-considered system of coöperation.

The roads should be returned to their owners to be operated by them, subject to a certain amount of governmental control. Thus the Interstate Commerce Commission policy of regulation of rates should be continued; and there is much to be said in favor of the creation of a Secretary of Transportation to consider carriers' estimates of future expenditures, including labor costs; to exercise supervision over security issues; and to fix rates designed to yield revenues sufficient for future operations and credits.

The railroads, as thus privately owned and operated, should be permitted to coöperate, where the object is to eliminate duplication of service and of facilities and to secure the most efficient use of routes, terminals and cars. Moreover, under Federal sanction, they should be free to effect consolidations which can be shown to be conducive to the mutual benefit of the public and roads themselves.

The Army and Aerial Mail Service

MUCH interest attaches to the successful termination of the transcontinental flight of four Army airplanes at Hazelhurst Field, Long Island, on January 7th and the start of the return journey to San Diego, Cal., last week. It marks the first serious effort on the part of the Government to gain an experience in aerial overland flying, that will help aeronautics immeasurably when it is put to commercial and industrial uses. Primarily the flight was undertaken to locate, photograph and aerially survey landing fields in the more remote country of our great Southwest, for the purpose of laying out possible aerial mail routes.

In its issue of December 21st, 1918, the SCIENTIFIC AMERICAN made plain the various uses to which the Government in its several departments could put the airplane, and it is encouraging to see that consideration is being given to one of the most important of those activities. If any Department of the Government is qualified to lay out the general routing scheme, surely it is the Department of Military Aeronautics with its thousands of aviators. Perhaps it can be induced to go even further and work out the problems of the Forestry Service in its Forest Fire Patrol Police, etc., for which it would be peculiarly qualified.

But without going too far afield in this discussion, we wish to record our conviction that the Government should consider very seriously having the Post Office Department employ the War Department to carry its aerial mail. Many advantages would accrue from an arrangement of this kind. First, the Post Office Department could depend upon the contractor and the contractor's ability to put a sufficiently large and experienced organization behind the work to insure its successful accomplishment. Second, instead of paying outside contractors for this service or maintaining an aerial force of its own, the Post Office Department would materially reduce its cost for such service, and at the same time make it possible for the Department of Military Aeronautics to ask for much lower appropriations from Congress for the maintenance, equipment and training of its military pilots.

The advantage of such an arrangement to our air forces is most evident. Ordinarily, to keep our military pilots in proper training and maintain their efficiency, it would be necessary that some of our largest flying fields be kept in service for the purpose of teaching the theory and practice of military aeronautics. These could be reduced in size in the event that the Post Office Department retained their services, and they would provide many service and supply stations in various parts of the country which would aid materially in the work of recruiting. Furthermore, where training was possible under actual commercial conditions, in which schedules must be maintained and discipline kept at its highest point, our military aviators would be more interested in their work than they would be in the relatively aimless flying at training schools.

Our Army has always been efficient. It built the Panama Canal when others failed. We believe it would make a success of our Aerial Mail Service!

The War's Influence on Naval Design

IT is too early as yet to predict what effect the experience gained during the war will have in modifying future naval designs in a broad way. Whether it will produce radical changes in our ideas of the relative values of the various types of fighting ship, it is too early to say positively; but the present indications are that a fighting fleet will consist, for many years to come, of battleships, battle-cruisers, well-armed scout cruisers, and destroyers.

Coming down to details, it is not our purpose to go elaborately into the matter just now, but rather to point out some of the lessons which apply more particularly to first-line fighting ships—that is, the dreadnought battleships and battle-cruisers.

The great increase in the length of capital ships due to the rapid development of the battle-cruiser, brings to the front the problem of stiffness and longitudinal strength. During the war the British had battle-cruisers in action and on patrol work, that were over 800 feet in length. The experience gained suggests that special attention must be paid to the matter of the girder strength, or the resistance to bending stresses of these great ships. The problem is rendered more difficult by the natural desire of the line officers who fight the ship, to have their vessel present as small a target as possible to the enemy, especially in respect to its height above the water-line. It was a matter of remark among the officers of our own fleet that when the surrendered German battleships and battle-cruisers came in sight, and particularly when they came abeam, they gave an impression of sitting very low in the water. The battle-cruisers "Renown" and "Repulse" give the same impression. This low freeboard and absence of lofty superstructures is all to the good in rendering it difficult for the enemy to score hits; but from a structural standpoint, it is all to the bad; for if we lengthen the ship without making a corresponding increase in her depth, we lose in girder depth and consequently lose enormously in girder strength—lose in fact as the square of the depth.

Closely associated with this is the tendency of late years among naval designers to flare their ships out above the water line at the bow, with a view to throwing the broken water away from the ship and preventing the blurring of the periscopes and gun-sight telescopes. In moderate seas no harmful effect is felt from these flared bows, but when these high-speed ships are driven hard into a heavy sea, the sudden increased displacement in the forward sections brings a sudden increase in the bending moments on the ship that is almost dynamic in its effect.

These conditions may be met partly by abolishing the flaring bows, thereby softening, as it were, the lifting effect of a wave, and by doubling up the plating and decks of the molded structure for a considerable distance amidships. Another method would be to carry the hull proper, one deck higher amidships.

Probably there is no more difficult task set before the naval architect than that of designing such huge vessels as our new battle-cruisers, 875 feet in length over all and of 35 knots speed. Their draft is subject to rigid limitations, their freeboard must be kept reasonably low. Consequently, compared with a trans-Atlantic liner like the "Aquitania" or the "Leviathan," they are very shallow for their great length. Furthermore, unlike the commercial ship, their enormous loads, due to the guns of 15- or 16-inch caliber with their immensely heavy barbettes, turrets, and magazines, are concentrated at certain specified points along the ship. To this is added the enormous weight of engines and boilers sufficient to give them their 180,000 or more horse-power.

The effect of this heavy concentration of weight and of the stresses due to the recoil of heavy guns, was shown in the case of the 35-knot ships of the "Furious" class, built during the war by the British. These vessels, of great length and comparatively shoal draft, were unable to stand the recoil of the two 18-inch guns, one forward and one aft, which were tried experimentally in the first ship of the class. The racking effect on the hull structure was such, we understand, that they were removed and 15-inch guns were substituted.

Another lesson of the war is the supreme importance of protecting the vitals of the ship against big-gun, high-explosive shell fire. It took the actual test of battle to show how searching is the flash of a bursting high-explosive shell of large caliber. The flaming gases of the explosion, white hot and under enormous pressure, search out the interior of the ship for unexpected distances. This was observed and commented upon by survivors from the "Blucher" which was sunk in the battle of Dogger's Bank early in the war. In the case of three British battle-cruisers at Jutland, the flash of 11- and 12-inch shells that came through the roofs or walls of the turrets, as the case might be, found its way down to the powder in the handling rooms in the bottom of the ship and set off the whole magazine. This happened in spite of the fact that the hoists to the guns were provided with cut-offs in the form of steel doors. Future construction will take note of this.

Necessarily these battle-cruisers are lightly armored compared with battleships. The protective value of armor was shown by way of contrast in the case of a battleship of the "Queen Elizabeth" class, which came under the fire of half-a-dozen German battleships. Although the ship was struck over 30 times by big shells delivered at moderate ranges, she came through without vital injury.

Aeronautics

A Record of 150 Loops was recently established by Lieut. William T. Campbell, Officer in Charge of Flying at Love Field, Dallas, Texas, with a Curtiss airplane. According to the Aero Club of America, this is the highest record. Lieut. Carl Batts held the previous record of 136 consecutive loops.

Crossing the Highest Andes.—Lieut. Dagoberto Godoy of the Chilean army crossed the Andes at their highest point in a Bristol biplane, donated by the British Government, on December 12th last. The aviator left Santiago, Chile, and crossed the Tupungato range at an altitude of 19,700 feet, landing at Mendoza, Argentine Republic.

Our Airplane Timber.—The latest available figures indicate that more than 132,056,288 feet of first-class airplane lumber was produced in the northwest during the war, through the efforts of the spruce division of the Signal Corps. These figures include production from August, 1917, when 202,264 feet were delivered, until October, 1918, when the production reached the high mark of 22,965,471.

Captain René Fonck's Record.—The highest official score for bringing down Hun fliers, according to *Flying*, goes to Captain René Fonck of the French army. Before the armistice was signed he was officially credited with 75 Boche planes, but virtually he brought down over 100. On two different occasions he brought down six machines in a few minutes. Fonck was a wonderful flier and was among the first to perform the "barrel" maneuver during an aerial battle. The French Government has conferred on him nearly every decoration in its power to give.

Airplane Parachute Prize.—Mrs. Louis Bennett, whose son, Lieut. Louis Bennett of the British Air Force, lost his life while flying at the front, has offered $500 to the Aero Club of America to be used as a prize in a contest to develop the invention of parachutes for use in escaping from airplanes which have caught on fire or got out of control. The offer has been accepted, and the club has formed a committee of the following members to organize a parachute competition: Major Thomas S. Baldwin, A. Leo Stevens, Colonel A. L. Fuller, Colonel Henry B. Hersey, Colonel James Prentice, Lieut.-Col. William Thaw, Major Cushman A. Rice, Congressman F. H. LaGuardia, Major R. W. Schroeder, Rear-Admiral Mark A. Bristol, Commander Henry C. Mustin, Commander John H. Towers, Lieut. Godfrey L. Cabot, Lieut. R. A. Preston, Commander P. N. Bellinger, Ensign Raffe Emerson, Henry Woodhouse, Frank S. Lahm, and Augustus Post. Although several successful types of parachutes have been employed during the great war, the relative merits of the various types have not been established, and it is for that reason that the competition is to be held in the near future.

The Ford of the Air.—A most important development is the production of a low priced, most useful airplane, which is the equivalent of a Ford automobile. This machine has been produced by the noted aeronautic engineer, Captain James V. Martin. In reality, Captain Martin produced this little airplane to supply the military need for a light fighter capable of climbing to 25,000 feet within a half hour, with two guns to fight raiding Germans, having a speed of over 100 miles an hour. To obtain these results he evolved new and ingenious methods of construction and trussing which greatly decreased the weight and head resistance. He also evolved a retractable chassis, which folds up like a bird folds his legs when in flight. By this one device there is eliminated 11/100 of the total head resistance of the airplance, so that the speed is thereby increased by 11 miles an hour. The K-bar trussing reduces the head resistance through the elimination of struts and wires and permits the increase of the gap and gives a higher factor of safety. The result is a very attractive little airplane, continues *Flying*, equipped with 40-horse-power engine, capable of carrying two passengers at a speed of from 70 to 80 miles an hour. A most remarkable feature is that this airplane will make about 22 miles on a gallon of gasoline. Having a span of only 18 feet, and weighing only 350 pounds, complete with motor, and having a landing speed of only 37 miles an hour, this plane can land on and start from almost any country road. It is expected to sell at about $2,000.

Science

Soil Surveys in the United States.—The Bureau of Soils of the U. S. Department of Agriculture reports that it carried out detailed soil surveys covering 38,136 square miles during the fiscal year 1918. The total area covered by such surveys up to the present time amounts to 483,961 square miles. Twenty-four states and four Federal bureaus are now coöperating in the work of soil surveys.

An Official Map of Uruguay.—The *Geographical Journal* reports that an official survey has been undertaken by the newly organized "Servicio Geográfico Militar" of Uruguay for the construction of a complete large-scale map of that republic. The prime mover in this enterprise and the director of the geographic service is Colonel Silvestre Mato. The map is to be published on two scales, 1/100,000 and 1/25,000, and will not be complete for many years.

An Immense Fund for Medical Research.—According to *Science*, the will of the late Captain J. R. De Lamar, mine owner and capitalist, leaves nearly half his $20,000,000 estate, in equal shares, to the Harvard Medical School, Johns Hopkins University and the College of Physicians and Surgeons of Columbia University for use in medical research and the dissemination of medical knowledge. The rest of the estate is left in trust to his daughter, with the provision that if she dies without issue the principal is to go to the institutions above named.

Density of Sodium Chloride Solutions.—The U. S. Bureau of Standards has recently made a number of density determinations on samples of sea water and other sodium chloride solutions. The data thus obtained, it is stated, will be of use to oceanographers. The Bureau has also prepared samples of sodium chloride solutions of various concentrations in connection with an investigation of the density-concentration relation and for the purpose of establishing a percentage scale for salt solutions for use in the manufacture of hydrometers to be used in the pickling industry.

The Journal of Geography, heretofore published under the editorship of Prof. R. H. Whitbeck at the University of Wisconsin, has been taken over by the American Geographical Society and will hereafter be published in New York. This interesting journal is issued chiefly for the benefit of teachers of geography in the elementary, secondary and normal schools, and does not compete with the *Geographical Review*, the chief organ of the American Geographical Society and the American equivalent of the Royal Geographical Society's *Geographical Journal*.

A Uniform Type for the Blind.—American libraries for the blind are rejoicing over the fact that they will no longer be obliged to have books in five different kinds of raised letters in order to accommodate readers taught in different parts of the country and at different periods. After many years of discussion a uniform type, to be known as "revised Braille," has been agreed upon, and hereafter all books embossed in this country are to be in the new type. "The Deserter," by Richard Harding Davis, was the first book to be published in revised Braille.

Reports of Snow on Highways.—In the winter of 1917-18, the Weather Bureau, in coöperation with the State Highway Commission of Pennsylvania, inaugurated a system of reports on the depth of snow at various points along the Lincoln Highway between Harrisburg and Pittsburgh. The reports were made by the assistant superintendents of highways to the Weather Bureau station at Pittsburgh, where they were bulletined and furnished to the press, as well as to automobile clubs and motor-track associations. The Weather Bureau also issued warnings of heavy snow for the mountain regions of Pennsylvania, so that steps might be taken to keep the roads open. This winter a similar service has been started in parts of New York and New Jersey, and the system will gradually become more general, in connection with the concerted efforts that are being made by state highway commissions, the Motor Transport Service of the Council of Nation Defense and the automobile associations to keep the main highways open during the season of heavy snows; especially the roads used as motor-truck, rural express and parcel-post routes.

Automobile

Starting in Cold Weather. On cold, winter days, and with the heavy gasoline now used, it is sometimes difficult to start the engine. If there is illuminating gas in the garage a quick and easy start can be made by slipping a rubber tube onto the gas jet and putting the other end into the air intake of the carburetor. The gasoline should not be turned on, nor the carburetor flooded, before the engine has warmed up.

Tanks Converted into Farm Tractors.—The little lightweight Renault "tanks" established an enviable reputation as fighting machines during the last year of the war, and now, in times of peace, they promise to become equally useful. Already some of them have been converted into agricultural tractors, by the removal of the guns and armor, and a few other slight modifications, and are said to be doing excellent service on the farms of France, where labor is painfully scarce just now. Another, and probably temporary use, that has been found for them is towing barges on canals, taking the place of horses.

Lubricating the Car.—An important direction in which we may hope to see material improvement in the near future is in the methods of lubricating automobiles. It is said that on some cars there are as many as 74 points where some sort of lubricant must be applied. Many of these are entirely inaccessible, and there is but little doubt many of these points are never discovered by the amateur owner who cares for his own car. A few years ago a car was brought over from the other side that contained a most ingenious, and apparently efficient, lubricating system in which there were but a very few points for the application of the lubricants, and these were all in plain sight and easy to get at; but as this car did not gain a foothold here its good features attracted but little attention. Now the matter is apparently being taken up by some of our manufacturers, and it is to be hoped that a much needed reform will result.

Oil vs. Grease.—Oil has always been a popular medium for lubricating the many wearing parts of the chassis because it was so easy to apply, and the fact is overlooked that oil will run out of a bearing just as easily as it will run in, and consequently constant attention is necessary to maintain proper lubrication. Indeed, this is only possible with a forced feed system which is not practical for the character of the bearings in the ordinary chassis. On the other hand, while grease is not so convenient to put into the cups it can be fed, under pressure, to most of the bearings thus insuring a more perfect film of lubricant in the bearing, and one of a character that will survive much better under heavy loads. Another good feature of grease as a lubricant is one that many an old time bicycle rider appreciated. With oil in a bearing there is a pumping action that tends to suck grit into the bearing, while with grease there is no such action, the grease always tending to work outward, thus not only sealing and keeping grit from gaining access to the bearing, but also tending to excrete any foreign matter that might have got in by some other way.

Cheap Fuel.—The search for a fuel that will be cheaper than gasoline, and equally as efficient, appears to be about as elusive as that for perpetual motion, and so far appears to have many of the same characteristics. Tests of the latest widely heralded fuel, which appears to be only a mixture having benzol as a base, do not seem to bear out the claims made for it; and, indeed, similar mixtures have been experimented with for at least five years in England without any very practical results. Undoubtedly benzol, either alone or combined with other inflammable liquids that can be vaporized or properly atomized, will form a valuable addition to our fuel supplies, but there is little probability that these compounds will supplant gasoline. So far little benzol has been used, as most of the supply has been required in the manufacture of explosives; and its future application will depend largely on the quantities in which it will be produced now that war demands are diminishing. In a sense benzol is a by-product, and as such but little attention was given to saving it before the war, except in Germany; but the experiences of late have warned us the world cannot tolerate waste, and it is hoped that greater quantities of this undoubtedly valuable motor fuel will be available in the future.

Personal combat games like wrestling develop the fighting instinct

Pushball is a favorite sport at some camps

How Uncle Sam Has Created an Army of Athletes

Training Camp Activities Which Worked Wonders in Permanent Physical Betterment of the Drafted Men

NOW that the great war is over, to all intents and purposes, it is interesting to reflect on what it has done for the vast body of civilians who a year and a half ago began to flow into our national army camps. We have had, in Europe and in the camps of this country, approximately 4,000,000 men, and it is safe to predict that the great majority of these will be benefitted for the rest of their lives by the course of intensive training through which they were put. In other words, Uncle Sam created not only an army of soldiers, but an army of athletes. These men are in infinitely better physical condition than they ever would have been, in all probability, had it not been for the war, and it is likely that the most of them will make an earnest effort to remain so.

It is perhaps natural to think that with drilling and other taxing tasks of the soldier, athletics would be a superfluous commodity in camp. On the contrary, it has been found that the more the men were inured to the vigorous use of their bodies, the more they longed for competitive games and tests of strength. It is a known fact that men relieved from duty in the first line trenches turn instinctively to strenuous games like football to gain the healthy equilibrium necessary to sleep.

From experience, too, it has been learned that an instantaneous muscular control is essential to the success of the fighter. For two military reasons—to develop the fighting instinct and to arm that instinct with control—there has been carried out a program of athletics unparalleled in history.

Uncle Sam considered athletics of the hard competitive sort that develops the fighting instinct of such importance that in the very beginning he summoned to his aid the very best talent the country possessed. Some forty men, among them many famous coaches, were assigned as sports directors in the several training camps. Organizing and directing the athletic activities of 40,000 men and maintaining an athletic program that will encourage the largest possible number of soldiers to participate regularly in some form of athletics during their leisure, is certainly a man's size job. But the reactions are remarkable. Football, baseball, basketball, soccer, boxing, wrestling, tennis, track and field athletics and all forms of winter sports were indulged in by all the men in training. Never before in the history of this country have so large a number of men engaged in athletics; never before has physical welfare received such a stimulus. Narrow-chested clerks made three-base hits on the same ball teams with college athletes, and lean-visaged philosophers learned how to use their fists. The book-keeper and the street-car motorman came to grips on the football field. Men learned to get bumped, and not to mind it. The quality of persistence was developed.

Tennis champions instructing the jackies in fine points of the game

Being attached to division headquarters, the division athletic director was able to coördinate his plans for inter-company and inter-regimental baseball or basketball leagues, track events, field days and the like, with the military routine of the different companies. He kept in touch with soldiers who naturally lead in athletics and attempted to stimulate the sporting element of their companies by the formation of a Divisional Athletic council, the members of which were in turn elected by the regimental councils. In the latter case, each company had its representatives and own athletic committee, so that the camp director was able to make things hum in an athletic way at any time and to stimulate the interest of the men of all the companies in camp.

The sports included in the camp curriculum, such as boxing, football, and other personal-contact games, were selected primarily to prepare the men for the struggle to come, and the value of the athletic training they received was fully realized as they went "over the top." Military authorities considered that boxing had great value in developing in the individual man the sense of confidence and aggressiveness that is generally desirable in a soldier, while it gives better than any other form of training a sound foundation for modern bayonet-fighting. Boxing and bayonet practice are closely allied; the same lunges and feints are employed; the men learn to be quick on their feet. Nor is this merely theoretical. The Canadian troops who have been at the front report that the agility and quickness of eye gained in boxing is a valuable part of the soldier's equipment.

Detailed groups of men who had had previous knowledge of this sport were trained by the boxing instructors to become their assistants. These boxing instructors, by the way, have included some world's champion pugilists. In many camps from two hundred to four hundred assistant boxing instructors were developed and gave instruction.

The growth of the popularity of boxing from a more or less forbidden sport to one adopted by the American army was one of the marvels of the war. Moreover, the soldiers were rabid fans. Camp bouts were frequent; even the Y. M. C. A. encouraged them, and made them a regular feature of the evening programs in the "huts." Last summer 40,000 khaki-clad soldiers and half as many civilians were spectators in a huge natural ampitheatre at a series of bouts between teams representing the 86th division, Camp Grant, and Canadian troops.

It is a unique fact that Camp Grant was the only camp in the country where any attempt was made to

A toboggan of solid snow 35 feet high built by the boys at Camp Grant

utilize the heavy snowfall and cold weather of last winter for winter sports. Six toboggan slides were in daily use and 50 toboggans were at the disposal of the men. In addition, 200 pairs of skis and 150 pairs of snow shoes were distributed, while six artificial skating rinks and 80 dozen hockey sticks were provided.

At Camp Grant use was made of the Brigade organizations as a clearing house for the distribution of equipment. Companies desiring to use any of the equipment would get it from the Brigade Athletic Officer and, after using it, return it for the use of the next organization. Thus several different groups were enabled to use the same apparatus in one day. According to Captain Lewis Omer, Athletic Director at Camp Grant and formerly director of athletics at Northwestern University, the winter sports proved most efficacious in neutralizing the bad effects of the super-heated air of the barracks with its enervating influence. The greatest enemy to the health of soldiers in winter was the stove. For this reason compulsory exercise of the play variety in the open air was instituted at Camp Grant, one hour a day being devoted to this.

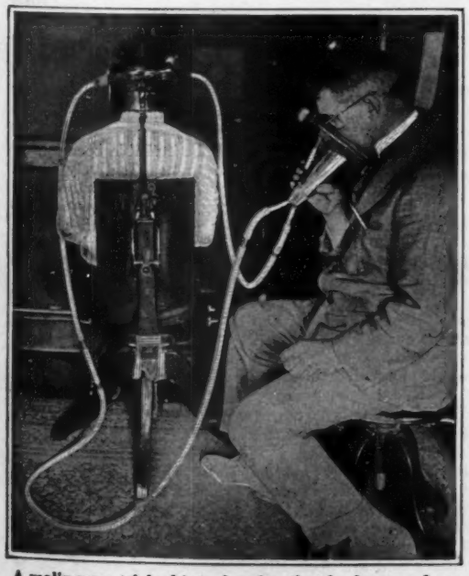
Camp Grant was also the first to put cross-country running into the scheme of mass athletic training. In the 183d Brigade weekly cross-country runs were held and the men brought to a point where they could run two and one-half miles in zero weather without any bad after-effects. In the middle of January approximately 1,000 men took part in one brigade run. The plan for developing cross-country running used at this camp was later put into effect in other camps.

As was to be expected, baseball proved to be the most popular of the summer sports. Every camp was provided with an immense field to be used as a parade ground, and, what is more essential, an athletic field. Some of those in the National Army cantonments were big enough to accommodate 20 diamonds, and these were put into full use, particularly on Wednesday and Saturday afternoons, which were veritable holidays in camp.

As an index of public interest, it is only necessary to mention that a football game between Camps Grant and Custer, held in Chicago last fall, brought in gate receipts of over $40,000. All of this money was devoted to purchasing athletic equipment for the two camps and for the boys already in France. The Government provided each company with a certain amount of athletic equipment—about 75 cents a man, which was not enough—but the men in many cases bought some things out of their own money, while every company had an "athletic chest" which they took to France with them. The Y. M. C. A. also made a heavy investment in baseballs, bats and gloves, basketballs, medicine balls, boxing gloves and wrestling mats; every "hut" was well provided for, and the soldiers could borrow almost anything they needed for a "catch" or a set-to in other games.

Not only were all of the well-known games, such as basketball, playground ball, volley ball, football, etc., played at the average camp, but frequently the division athletic directors invented new games. And one phase of camp athletics, which is hardly touched upon by the colleges, was laughter-compelling games. This was important, for good humor is one of the vital elements of discipline. The games were popular, too. In addition to numerous improvisations, leap-frog, prisoners'-base and a dozen other games that even school boys have outgrown, afforded the men intense enjoyment, and served the additional purpose of promoting good feeling and developing self-control, agility, mental alertness and initiative, all bases on which to build military efficiency.

One of the indoor sports upon which the men fall back in bad weather



A malingerer tricked into denying that he hears, when the doctor can prove that he does hear

Doctor vs. Malingerer

IT was an observation of the ancients that the greater pain obscures the less and that, in a general way, strong sensations prevent the appreciation of weaker ones. In precise terms, stimuli that are similar in all their properties except intensity are not dissociated by the mind, only the stimulus of greater intensity being so registered that we are conscious of it. This law was utilized with much success by Dr. John F. Callahan of Brockton, Mass., in the detection of malingerers who sought to evade the draft by false claims of deafness in one ear—a common practice.

When a sound reaches each ear with the same intensity we are conscious of hearing it in both. When it reaches each ear with different intensities we are conscious of hearing it only in the ear where intensity is the greater. Thus tuning forks vibrating with the same pitch and loudness one inch from each ear are heard in both ears; but if the fork at the left ear is removed to a point three inches away this sound is lost and only the fork remaining at the right ear is heard. But if now, the latter is put six inches back, it will no longer be heard, while the left one, formerly not sensed, will become audible.

Dr. Callahan early convinced himself that tests which depend upon the suspected malingerer not knowing in which ear he hears the test sounds are an insult to his intelligence; the patient can successfully concentrate his attention on his good ear and suppress what he hears in his supposedly bad ear. The most we could here expect would be to trick a patient who was not very sharp; and even then we could merely ascertain that he was not totally deaf in his "bad" ear—we could never determine the extent of hearing he had in that ear. So Dr. Callahan has worked out a procedure where the patient knows which ear does the hearing, but where he is betrayed by his ignorance of which one ought to do it if his claims were correct.

The sound is brought to the patient's ears through rubber tubes. It is necessary to eliminate the possibility of bone conduction, since the vibration in the tubes can often be felt with the hand. So instead of being attached to the patient's head with lugs, the tube-ends terminate in a curved arm attached to the chair-top; and after the patient is seated, these ends are brought to within an inch of his either ear, without any contact between him and the apparatus.

The sound may be produced in various ways. Dr. Callahan has used tuning forks, and a megaphone manufactured from an old ether cone. In the former case, the desired length of tube is got by a metal clip joining the two tubes, which at the same time makes it possible to use a single fork; and the parts of the tubes beyond the clip simply do not figure in the test. In the vocal test, where the cone has actually to be at the physical end of both tubes, metal couplings and auxiliary tube-lengths are used. In either event, the mechanical details are sufficiently obvious.

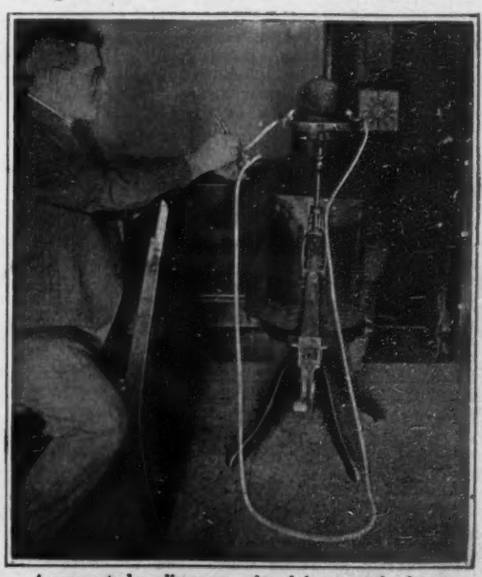
If the patient has two good ears, when the tubes are of the same length he will hear the sound in both ears. There will be a neutral zone of two or three inches around this point in which the same result will be obtained. But the minute either tube becomes appreciably longer than the other, audibility will be confined to the ear that pertains to the shorter segment.

If the patient really has a bad ear, each ear will have been tested separately; it will be found, say, that he hears in his good ear up to 20 feet, and in his bad ear up to 3 feet. With both tubes in use at the same time, he will hear the sound in his good ear whenever the length of the tube leading to it is less than 20 feet while that of the tube leading to the bad ear is greater than 3 feet. The minute we get his bad ear within 3 feet of the sound while the good ear is 20 feet or more away, he will hear in the bad ear. And proceeding from this point to move the sound nearer to both ears at once, if it is 6 inches from the bad ear and 18 feet from the good one, the intensity *of audition* will be greater in the bad ear. The patient will then hear in the bad ear, and the good one will register no sound—although if the bad ear were closed, he would hear in the good one.

Suppose now that a malingerer has claimed deafness in his left ear. If he claims partial deafness he will be tripped up in short order by sounds whose intensities and distances are not known to him; so realizing this, he claims total deafness in the ear in question. He must then go into the test with the determination to say no whenever he hears a sound in his left ear; otherwise he will presently admit hearing something which he should not hear. Very well; in the case outlined in the preceding paragraph, he hears the sound in his bad ear, and denies hearing it at all. Then he is caught; for if his left ear were deaf he would hear it in his right, and if his left ear were not deaf he would hear it in his left.

Of course the distances in the above suppositious case will be greatly modified according to the facts of each case. But in every case there will be a region where the malingerer hears the sound in his "bad" ear, so that he must deny hearing it at all, yet in which he could hear it with one ear or the other if his claims were true. Thus, suppose he really hears at 30 feet in his left ear and at 20 feet in his right, and has claimed deafness in his right ear. When the tubes are so adjusted that the source of sound is 10 feet from his left ear and 6 feet from his right, he will deny hearing at all!

In every case the range of the good ear can be determined in advance by separate tests of the two ears; and in every case the patient, by his negative answer, unconsciously gives exact information as to just what degree of hearing he has in his alleged bad ear. For as the sound-source retreats from the good ear and approaches the bad one, he marks the point at which he begins to hear it in his bad ear by changing his claim from "hear" to "do not hear." There seems no escape for the unfortunate victim of Dr. Callahan's ingenious device—except that of telling the truth about his hearing to begin with.



A suspected malingerer, who claims one deaf ear, tested with a tuning fork instead of the voice

The Principles of Camouflage—II

Low Visibility and Optical Illusion on the Sea

By M. Luckiesh

AT the time of the Spanish-American War our battleships were painted white apparently with little thought of attaining low visibility. Later the so-called "battleship gray" was adopted but it has been apparent to close observers that this gray is in general too dark. Apparently it is a mixture of black and white. The ships of the British navy were at one time painted black but preceding the Great War their coats were of a warm dark gray. Germany adopted dark gray before the close of the last century and Austria adopted the German gray at the outbreak of the war. The French and Italian fleets were also painted a warm gray. This development toward gray was the result of an aim toward attaining low visibility. Other changes were necessitated by submarine warfare which will be discussed later.

In the early days of unrestricted submarine warfare many schemes of modifying the appearance of vessels were submitted. Most of these were merely wild fancies with no established reasoning behind them. Here again science came to the rescue and through research and consultation, finally straightened out matters. The question of low visibility for vessels could be thoroughly studied on a laboratory scale because the seascape and natural lighting conditions could be reproduced very closely. Even the general weather conditions could be simulated, although of course the experiments could be prosecuted outdoors with small models as indeed they were. Dr. L. A. Jones carried out an investigation on the shore of Lake Ontario and laboratory experiments were conducted by others with the result that much light was shed on the questions of marine camouflage. This work confirmed the conclusion of the writer and others that our battleship gray was too dark. Of course, the color best adapted is that which is the best compromise for the extreme variety in lighting and weather conditions. These vary in different parts of the world, so naturally those in the war zone were of primary importance. All camouflage generally must aim to be a compromise best suited for average or dominating conditions. For example, in foggy weather a certain paint may render a ship of low visibility but on a sunny day the ship might be plainly visible. However, if ships are rendered of low visibility for even a portion of the time it is obvious that an advantage has been gained. Cloudiness increases generally from the equator northward as indicated by meteorological annals.

A Scale of Visibility

In order to study low visibility a scale of visibility must be established and it is essential to begin with the fundamentals of vision. We distinguish objects by contrasts in brightness and in color and we recognize objects by these contrasts which mold their forms. In researches in vision it is customary to devise methods by which these contrasts can be varied. This is done by increasing or decreasing a veil of luminosity over the object and its surroundings and by other means. Much work has been done in past years in studying the minimum perceptible contrast and it has been found to vary with hue, with the magnitude of brightness, and with the size of the image; that is, with the distance of an object of given size. In such problems as this one much scientific work can be drawn upon. A simple though rough scale of visibility may be made by using a series of photographic screens of different densities. A photographic screen is slightly diffusing, still the object can be viewed through it very well. Such methods have been employed by various investigators in the study of visibility.

Owing to the curvature of the earth the distance at which a vessel can be seen on a clear day is limited by the height of the observer and of the ship's superstructure. For an observer in a certain position the visibility range varies as the square root of the distance of the object from him. Such data are easily available so they will not be given here. So far we have considered the ship itself when as a matter of fact on clear days the smoke cloud emitted by the ship is usually visible long before a ship's superstructure appears over the horizon. This led to the prevention of smoke by better combustion, by using smokeless fuels, etc.

The irregular skyline of a ship is perhaps one of the most influential factors which tend to increase its visibility. Many suggestions pertaining to the modification of the superstructure have been made but these are generally impracticable. False work suffers in heavy seas and high winds.

Countershading to Increase "Low Visibility"

After adopting dark gray as a "low-visibility" paint for ships, perhaps the next refinement was countershading, that is, shadows were painted a lighter color or even white. The superstructure was painted in some cases a light blue with the hope that it would fade into the distant horizon. However, the effectiveness of the submarine demanded new expedients because within its range of effectiveness no ingenuity could render its prey invisible. The effective gunfire from submarines is several miles and torpedoes can be effective at these distances. However the submarine prefers to discharge the torpedo at ranges within a mile. It is obvious that in average weather low visibility ceased to be very effective against the submarine. The movement of a target is of much less importance in the case of gunfire than in the case of the torpedo with its relatively low velocity. The submarine gunner must have the position, range, and course of the target in order to fire a torpedo with any hope of a hit. Therefore any uncertainties that could be introduced pertaining to these factors would be to the advantage of the submarine's prey. For example, low visibility gave way to confusibility in the discussions of defense against the submarine and the slogan, "A miss is as good as a mile" was adopted. None of the foregoing factors can be determined with high accuracy so that it appeared possible to add somewhat to the difficulties.

THE art of deception in war is as old as war itself, but never has it received such close, scientific attention as in the mighty struggle the world has just passed through. Early in the war it became evident that while an artist might deceive the naked human eye, the deception would be perfectly transparent to the photographic camera. A complete knowledge of the composition of color was imperative. Here the services of the physicist had to be called in. Not only was color used to hoodwink the enemy but all manner of optical illusions; here also the physicist was needed. And so many prominent scientists were enlisted to reduce camouflage to a science.

Among the physicists who had contributed to the scientific development of camouflage was the author of the present article, who is a well known color expert. Mr. Luckiesh, therefore, writes with authority. His first instalment, dealing with camouflage on land, was published in the SCIENTIFIC AMERICAN *of January 25, 1919. The third and last instalment, which will be published in an early issue, will deal with invisibility of airplanes.*—EDITOR.

Optical Illusions to Distort the Lines of a Ship

Many optical illusions have been devised and studied by scientists. In fact, some of these tricks are well known to the general reader. Straight lines may appear broken, convergent, or divergent by providing certain patterns or lines intermingled with them. Many of these were applied to models in laboratory experiments and it has been shown that confusion results as to the course of the vessel. The application of these on vessels has resulted in the grotesque patterns to be seen on ships. It is well known that these illusions are most effective when the greatest contrasts are used, hence black and white patterns are common. Color has not been utilized to any appreciable extent in confusibility although there is a secondary aim of obtaining low visibility at a great distance by properly balancing the black, white and other colors so that a blue gray results at distances too great for the individual patterns to be resolved by the eye. Color could be used for the purpose of increasing the confusion by apparently altering the perspective. For example, blue and red patterns on the same surface do not usually appear at the same distance, the red appearing closer than the blue.

Such apparently grotesque patterns aimed to distort the lines of the ship and to warp the perspective by which we estimate the course. This was the final type of camouflage at the close of the war. Besides relying upon these illusions, ships zigzagged on being attacked and aimed in other ways to confuse the enemy. Little attempt was made to disguise the bow because the bow wave was generally visible. However, attempts have been made to increase it apparently and even to provide one at the stern. In fact, ingenuity was heavily drawn upon and every plausible expedient has been tried.

The convoy system is well known to the reader. This saved many vessels from destruction. Vessels of the same speed were grouped together and steamed in flocks across the Atlantic. Anyone who has had the extreme pleasure of looking down upon these convoys led by destroyers and attended by chasers is strongly impressed with the old adage, "In unity there is strength."

Before the war began a Brazilian battleship launched in this country was provided with a system of blue lights for use when near the enemy at night. Blue was adopted doubtless for its low range compared with light of other colors. We know that the setting sun is red because the atmospheric dust, smoke, and moisture have scattered and absorbed the blue and green rays more than the yellow and red rays. In other words the penetrating power of the red and yellow is greater than that of the blue rays. This country made use of this expedient to some extent. Of course, all other lights were extinguished and portholes were closed in ocean travel during the submarine meance.

Smoke Screens

Naturally smoke screens were adopted as a defensive measure on sea as well as on land. Many types of smoke boxes have been devised or suggested. The smoke is produced chemically and the apparatus must be simple and safe. If a merchantman were attacked by a submarine immediately smoke-boxes would be dumped overboard or some which were installed on deck would be put into operation and the ship would be steered in a zigzag course. These expedients were likely to render shell-fire and observations inaccurate. This mode of defense is best suited to unarmed or inferiorly armed vessels.

Camouflage for Submarines

So far as the writer has been informed no attempts have been made to camouflage submarines under water but that this can be done is evident from aerial observations. When looking over the water from a point not far above it we are unable to see into the water except at points near us where our direction of vision is not very oblique to the surface of the water. The brightness of the surface of water is due to mirrored sky and clouds ordinarily. For a perfectly smooth surface of water the reflection factor is two per cent for perpendicular incidence. This increases only slightly as the obliquity increases to an angle of about 60 degrees. From this point the reflection factor rapidly increases, becoming 100 per cent at 90 degrees incidence. This accounts for the ease with which we can see into water from a position directly overhead and hence the airplane has been an effective hunter of submarines which are submerged. The depth at which an object can be seen in water of course depends upon its clarity. It may be surprising to many to learn that the brightness of water, as viewed perpendicularly to its surface is largely due to light diffused within it.

A submerged submarine may be invisible because:

(1) It may be deep enough to be effectively veiled by the luminosity of the mass of water above it (including the surface brightness) or

(2) It may be of the proper brightness and color to stimulate the brightness and color of the water.

It is obvious that if it were black or white it would have to attain concealment by submerging deeply. If it were a fairly dark greenish blue it would be invisible at very small depths. In fact, it would be of very low visibility at the surface of the water. From the writer's data on hues and reflection factors of earth and water areas it would be easy to camouflage submarines effectively from enemies overhead. The visibility of submarines is amplified by viewing large fish such as sharks from airships at low altitudes. They appear as miniature submarines, dark gray or almost black amid greenish blue surroundings. Incidentally the color of water varies considerably from the shallow inland waters containing much suspended matter to the deep clear ocean waters. The latter as viewed vertically are about one-half the brightness of the former under the same conditions and are decidedly bluer. Inland waters such as the Chesapeake Bay are very greenish in color.

Worlds of Four Dimensions

A Field of Mathematics Equally Interesting to Student and Layman

OF the infinite variety of topics to be found in mathematics, there are a few which are ever fresh in their public appeal. The categorical statement of the mathematician that the circle cannot be squared or the cube duplicated or the angle trisected under the rules which he has laid down to govern attack upon these problems always intrigues the lay mind. And in the same way, an innocent bystander who remains cold to logarithms and derivatives and Taylor Series and determinants and other things which are to him but words, will react at once to the most casual mention of the fourth dimension and four mutually perpendicular lines through a point. For here are phrases which convey a meaning to him, and moreover a meaning that seems to contradict all his experiences; so he feels that he must stay with them. According to his type of mind he will stay to scoff or stay to learn; but he will stay. We have yet to meet a person of intelligence who was not sufficiently attracted by the term "fourth dimension" and the things it suggests to want to hear more about it.

Many of the readers of the SCIENTIFIC AMERICAN will recall the prize competition of nearly ten years ago for essays explaining what mathematicians mean when they speak of the fourth dimension. The number of contestants was so large, and the collateral interest so widespread, that publication in book form of a few of the better of the essays seemed worth while. It turned out to be so well worth while that the edition was exhausted, and the book has been out of print for some time. A new edition has recently come from the press; and its perusal by one who had not previously seen the book is responsible for these remarks.

The volume contains, in addition to the prize-winning essay and a brief afterword thereto, 20 of the competing essays selected purely with a view to presenting as many aspects of the subject as possible, and a comprehensive and well-executed introduction by Dr. Manning of Brown University, one of the judges in the competition. As was to be expected, the essayists bear down heavily and almost unanimously upon the better-known features of four-dimensionality.

The natural passage to four dimensions by considering in order point, line, plane, solid and hyper-solid is found in most of the essays; and a great deal is said about flatlands and worlds of one dimension. Even in this rather hackneyed field, however, we find a wide choice of illustration; and particularly pleasing is the variety of the arguments offered in demonstration of the number of points, lines, planes and three-spaces necessary to delimit the tesseract, or hyper-cube in four dimensions.

The usual amount of space is devoted to the tricks of the fourth dimension—the penetration of closed compartments, the appearance and disappearance from three-space, the interchange between symmetric forms, the turning inside out and the unraveling of knots without disturbing the ends—although in several cases it is necessary for Dr. Manning to interpose the weight of his authority between the individual contributors and the errors so commonly found in discussions of these items.

A point which will be new to some of those interested in hyper-space is the fact that certain chemical isomers appear to differ only in that their molecules or crystals are symmetrically instead of identically formed, and that in some cases there seems to be free passage from the one form to the other without any manifestation of chemical change and without evolution or consumption of heat. An explanation of such changes—though hardly the only explanation, as some of the essayists assert—would be found in the hypothesis of rotation through the fourth dimension. None of those who advance this possibility makes the rather obvious suggestion that if our space has an infinitesimal thickness in the direction of a fourth dimension, and if penetration in that direction be physically impossible save to the extent of that thickness, the occurrence of such rotations only in the infinitesimal would be accounted for.

Perhaps the most noteworthy of the unfamiliar ideas advanced in this little book is that which suggests that we visualize time as a fourth dimension, and consider bodily growth, observed at a series of different stages, as a series of cross-sections taken across the fourth dimension. Such a group of "traces," as the geometer would doubtless permit us to call them, perhaps comes as close to actual realization of a fourth dimension in our world of points as we can hope to come.

But why confine the discussion to a world of points? It has always seemed to us that the doctrine of hyper-dimensionality suffers a distinct loss through such confinement. It is true that we humans conceive of our universe as a manifold of points. The very fact that we do so conceive, however, in conjunction with the fact that the universe of our perceptions is indubitably three-dimensional in points, suggests strongly that light would be thrown upon the concept of a four-dimensional manifold of points by the construction and consideration of four-dimensional manifolds of other elements.

Our own familiar "three-space" is four-dimensional in lines, and if it is unnatural for us to think of the line as the element of which space is constituted, we can at least force ourselves to do so, and there is not the slightest *a priori* reason for not doing so; our space is four-dimensional in spheres, and actually six-dimensional in circles. Those of us who have heard Dr. Keyser talk or who have read his essays on this aspect of mathematics will realize well that, mathematically, the point as the space element is purely an accident, and that even so complicated an element as a pencil of lines is by no means unthinkable.

In several places, notably in the introduction, "The Fourth Dimension Simply Explained" has a good deal to say of the sort of non-Euclidean geometries got by imposing, upon Euclid's point-element, alternative sets of postulates. These systems indeed throw light upon hyper-space and hyper-dimensionality; but we do not see that they throw nearly so much light as this other sort of non-Euclidean geometry, got by imposing the Euclidean or Lobatchevskian or Riemannian postulates upon a set of elements other than points. Our one regret, in leaving this absorbing volume, is that it has nothing to say under this head.

Correspondence

The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.

A Strong and Adequate Navy

To the Editor of the SCIENTIFIC AMERICAN:

I am greatly pleased at the attitude of the article by Mr. Hudson Maxim in your issue of January 4th as to increasing the size of our Navy. I am enthusiastic about maintaining a strong and adequate navy. The description, "strong and adequate" may appear ambiguous, but to me it means a navy at least 20 per cent stronger than that of any other naval power, except England, and, remembering that Germany's strength is temporarily eliminated, say, two-thirds the strength of England. I cannot agree with Admiral Badger and the *New York Times* (January 12th) that now is the time to speed up and take first place.

To understand the magnitude of this proposed expansion one has only to look at the figures comparing naval tonnage built and building, as shown in our official Navy Year Book (1916, the latest issue, p. 646, insert):

England—2,713,756 tons, built and building.
Germany—1,304,640 tons, built and building.
United States—1,041,164 tons, built and building.

England, in her isolated geographical situation, her absolute dependance on sea transportation for food and raw materials, and her large and scattered dependancies, has ample reason to insist on first place, reasons which pertain not at all to the United States.

To speed up in naval construction at this time with first place in view would only force England to speed up in corresponding measure to retain her present commanding position, with needless and fabulous expense to both nations.

It may be that Admiral Badger has in mind some financial artesian well bubbling up unlimited dollars, and unknown to the rest of us.

It seems very strange to urge such a lavish expenditure in naval expansion at this time, especially as some of those now urging, thought, before the war, that third or fourth place was plenty good enough for this country, the richest nation on earth. We then carried a national debt of about one billion dollars. We shall soon carry a national debt of over twenty billions. How can they demand that we pour out the unstinted money that such a program will call for? As a very clear-headed old sea-dog, the admiral commandant of the Brooklyn Navy Yard, said to the Naval Committee of Congress in my hearing, "A naval officer has been trained to spend money, not to save it."

It is my belief that a navy of equal tonnage would cost the United States at least 20 per cent over England, owing to our higher wage scale and more extravagant naval management (for example our maintenance of political or sectional but absolutely unnecessary navy yards).

How much easier it would be, with this enormous debt staring us in the face, for Congress simply to make adequate provision for the fundamentals—dreadnoughts battle-cruisers and destroyers—of a reasonable navy, and to slow down on all other construction to the lowest possible limit, building only enough submarines and hydroplanes fully to stimulate invention and improvement; *no more*. They should put aside the idea that a navy, to be efficient, must man and maintain every naval vessel and burn coal or oil under every naval boiler.

After all our troops are brought home, the obsolete battleships of the second line could be put "in ordinary" in the fresh water basin at League Island Yard, together with all obsolete cruisers, destroyers, submarines, and other naval craft. With only the modern up-to-date ships, built and building, in active commission, we would still have a Navy that every loyal American could be proud of, both as to efficiency and economy.

Permit me to congratulate you on Mr. Maxim's splendid and sensible article.

GEO. A. LOUD, Ex. Member of Congress.

Bay City, Mich.

P. S.—I served 11 years on Naval Committee and one year on Merchant Marine and Fisheries. I served, also, in Dewey's fleet at Battle of Manila.

The Transatlantic Airplane Hoax

To the Editor of the SCIENTIFIC AMERICAN:

There has been so much printed recently indicating that the successful transatlantic airplane flight is a thing of the future, though one looked forward to with great expectations, that I beg to quote the following from the correspondence column of the San Francisco *Chronicle* of December 22d, bearing the signature E. W. B., Berkeley, Cal.:

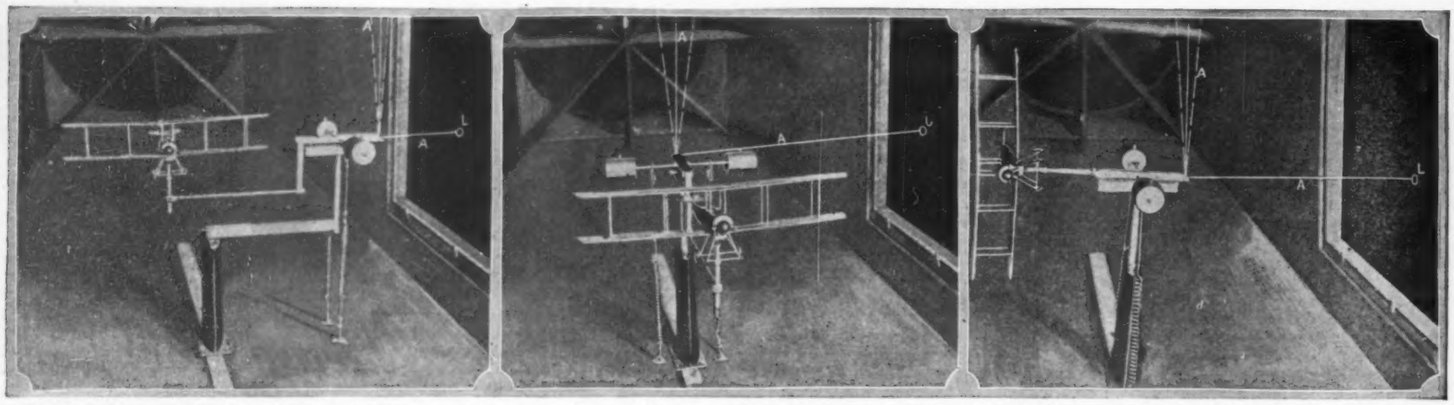
"For the information of A. W. C., Grass Valley whose inquiry regarding the crossing of the Atlantic by an airship appeared this morning, please be informed that such a flight was made July 28th-29th, 1918, to celebrate the birthday of Mr. Allen R. Hawley, president of the Aero Club of America. The start was made from Harbor Grace, Newfoundland, at 4.02 P. M. (seven hours, two minutes, Greenwich mean time), Sunday, July 28th, and the landing at Dingle Bay, Ireland, at 4.12 P. M. (seven hours, twelve minutes, Greenwich mean time), Monday; time, 24 hours, 10 minutes. For an interesting description and navigator's log of this flight, see United States Naval Institute Proceedings, Vol. 44, No. 187, September, 1918."

I am a close reader each week, and have been for a great many years, of your publication, but I am unable to recall that your columns have recorded the fact that the Atlantic has already been successfully crossed by a flying machine. Assuming that the subject matter of this communication interests a large number of your readers, would you not at your convenience reproduce this communication in your columns and advise whether you can confirm?

JOHN S. INGLIS.

San Francisco, Cal.

[The flight to which this correspondent refers was a fictitious one. The yarn first appeared in "Flying," and was reprinted, presumably on the ground of its historic interest, in the Naval Proceedings. We do not know whether it was originally intended as a hoax, or whether it was assumed that readers would recognize that the account was purely fiction. Judging from the number of letters which we have received, and of which the above is but a sample, we should say that the omission clearly to state the fictitious character of the original publication and of the reprint was an unfortunate one.—THE EDITOR.]



Model airplane in position to display pitch (left), roll (center) and yaw (right) when blown upon from the opening in the background. In each case L represents the spectacle lens which admits light to the chamber, and A-A the pencil of light which is deflected to a scale on the roof and there records the oscillations of the plane

The Instability of American Airplanes

Sources of the Defects That Have Killed Many Pilots Revealed by Experiments That Reduce Aerodynamics to the Elementals

By W. H. Ballou, Sc.D.

UTILIZING the Hodgkins fund for the advancement of science, of which the Smithsonian Institution at Washington is custodian, intensive investigations have been made at the Massachusetts Institute of Technology, Boston, on the dynamical stability of American airplanes, together with the wind tunnel experiments in aerodynamics. The investigators comprised Assistant Naval Constructor Jerome C. Hunsaker, U. S. N., Captain V. E. Clark, U. S. A., C. L. Brand, T. H. Huff, D. W. Douglas, H. K. Chow, E. Buckingham, H. E. Rossell and E. B. Wilson, Bachelors and Masters of Science.

The technical reports rendered by these competent investigators reveal defects in American designs that are responsible for so many accidents and deaths of apprentices and professionals on the training grounds of this country, and which have been laid to enemy sabotage apparently without cause. These accidents and deaths have run in greater percentage on practice work at home than in actual warfare abroad with foreign machines, barring, of course, machines and men destroyed by hostile fire. The inference from the reports is that American manufacturers have not taken the same corrective advantage of remedies as have foreigners who have had constant inspection of machines in flight. In America there were merely trials of machines; abroad, machines got their tryouts in actual service, resulting in quick remedies of many defects.

It may be stated in advance that the investigators have not found remedies for all defects. Far from it. Aviation is still in the experimental stage. The defects and remedies pointed out apply only to what airplanes are today. The perfected airplane is a matter of tomorrow, that is, the airplane which like David Harum's horse "will stand without hitchin' and a woman can drive it." A perfected airplane will be a machine that will wholly replace the automobile, that men, women and children will be as safe and as delighted with as the automobile and as capable of driving; also one that will really annihilate time and space in travel.

An attempt will be made herein to summarize in understandable language, the reports of the airplane investigators, within the limits of an article, omitting very properly, the names of the manufacturers, who, under the stimulus of war, will undoubtedly take full advantage of any and all remedies offered conclusively. Where possible, exact quotations will be made, but much reduced. Much of the experimental work was performed by Messrs. Huff and Douglas. The oscillating apparatus for longitudinal motion was designed by Mr. Chow, under direction of Prof. E. B. Wilson, of the Institute's mathematical department. Captain Clark, while a student of the Institute in aeronautical engineering, designed an airplane which was selected as one type inherently stable for investigation. Another type was an American military machine, which possessed powerful controls but no particular degree of stability.

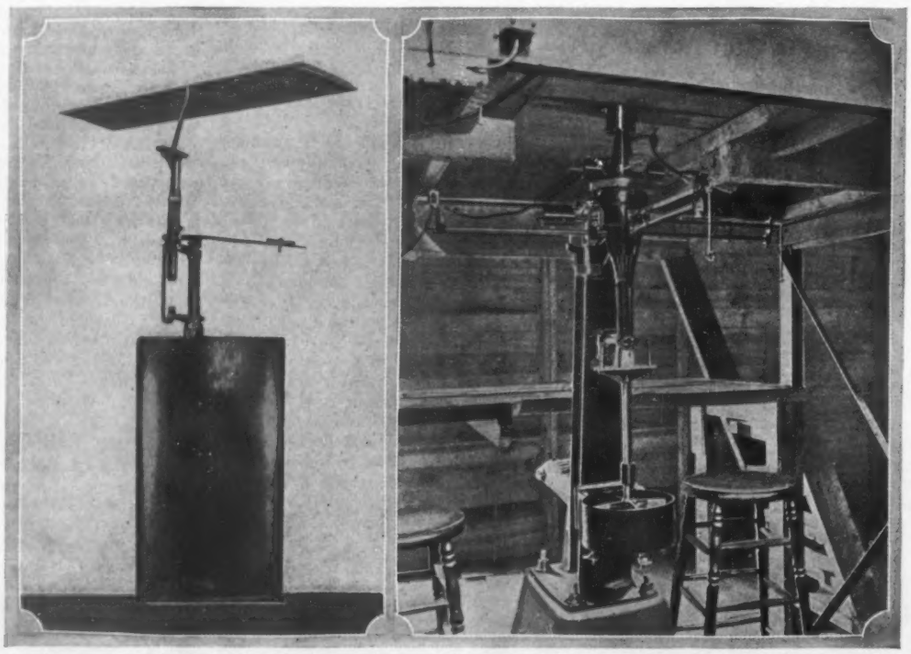
"The comparison of the two types led to the conclusion that inherent dynamical stability, both longitudinal and lateral, may be secured in an airplane of current type by careful adjustment of its surfaces and without material effect on controlability or performance. It is found that longitudinal motion, if disturbed by any accidental cause, is a slow undulation involving a rising and sinking of the airplane as well as a pitching motion. This undulation is stable for high speeds since it is rapidly damped out. At lower speed, the undulation is less heavily damped until at a certain critical low speed the damping vanishes. For speeds below this critical speed, the undulations tend to increase in amplitude with each swing and the longitudinal motion is, therefore, unstable. The military machine showed a critical speed below which it was longitudinally unstable.

"It is a simple matter to secure any desired degree of longitudinal stability, which is here for the first time pointed out, by the use of properly inclined tail surface and light wing loading. Excessive statical stability, as indicated by strong restoring moments, is undesirable and may cause the motion to become violent in gusty air. This violence of motion may seriously impair the pilot's control and the airplane may 'take charge' at a critical time. Longitudinal motion for any particular speed may be made dynamically stable, while at the same time only slightly stable in the static sense, by the use of large tail surface which lies very nearly in the relative wind. If the minimum of statical stability be combined with the maximum of damping, the pitching will be very slow and heavily damped. The longitudinal motion can then be dynamically stable and yet be without violence of motion in gusty air.

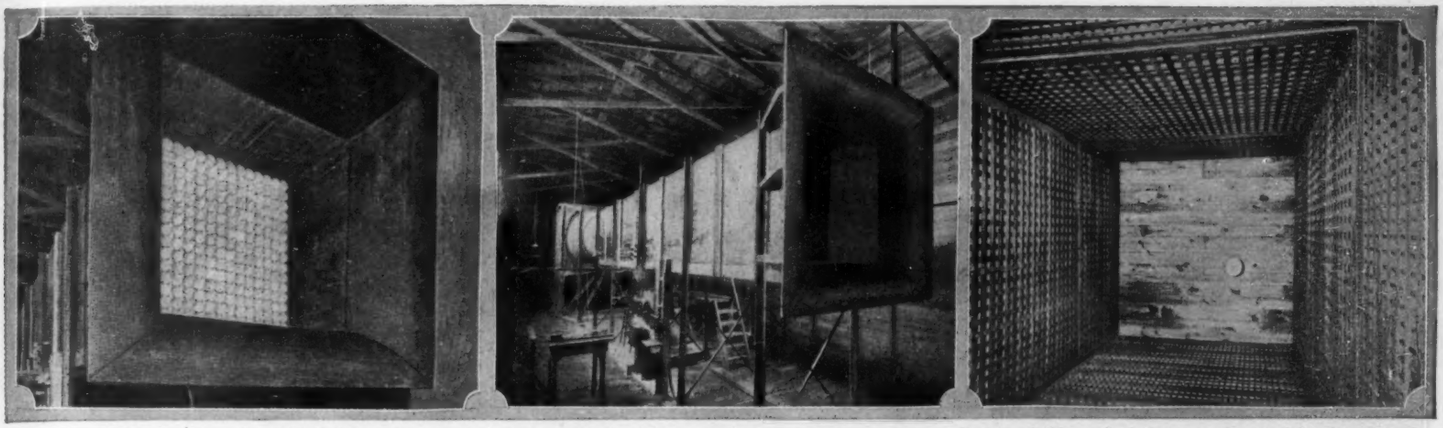
"The general prejudice among pilots against 'very stable' airplanes is believed to be justified. It cannot be too strongly insisted upon that true dynamical stability is better given by damping than by stiffness. Experience with rolling vessels has led to the design of types of small metacentric height (a measure of statical stability), fitted with bilge keels (damping surface) for passenger carrying. Here, an effort is made to get away from the violence of motion associated with stiffness.

"We determined necessary aerodynamical constants by wind tunnel experiments wherever practical, and calculated by simple approximate method, two coefficients which cannot be readily found experimentally. The character of the motion is indicated in a general way by these coefficients, obtained algebraically. It was ascertained that lateral motion is a combination of roll, yaw and side slip, or skidding. One type of motion is a spiral subsidence if stable, or divergence if unstable. One type of machine becomes spirally unstable at low speed. The motion is a spiral dive, due to an overbank and a side slip inwards. The airplane makes a rapid turn with rapidly increasing bank accompanied by side slipping inwards. The instability is such that an initial deviation from course will double itself in about seven seconds. Such spiral motion may be made stable by adequate fin surface above the center of gravity or upturned wings and by reduction in weather helm due to too much rudder or fin surface aft. The American military machine showed the same sort of spiral instability at high speeds. It had no dihedral angle of wings but had a large rudder and deep body."

Whether so intended or not, the above paragraph obviously explains deaths and



At right, the aerodynamical balance beneath the wind tunnel; at left, the upper end that projects into the tunnel, bearing, in the picture, a model wing whose rotating moments are being investigated



Details of the wind tunnel. At left, the entrance nozzle, showing end of honeycomb; in center, a more general view of this end of the tunnel; at right, interior of the diffusor, looking from the propeller

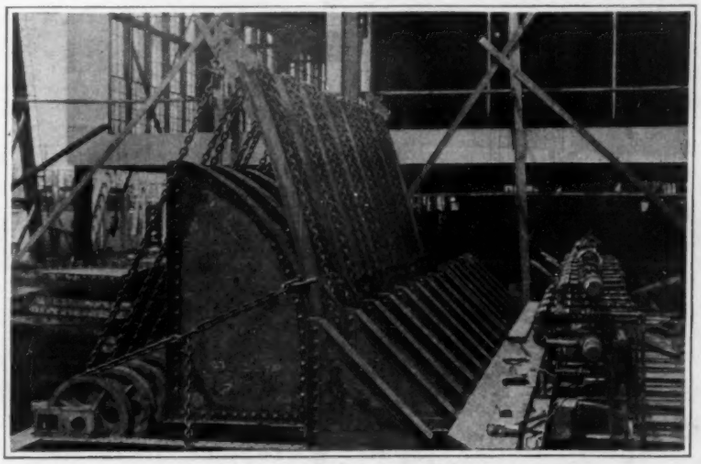
accidents in pockets, or vacuums in the air. A machine going at high speed, spirally unstable, plunges into the pocket, turns tail up, and dives toward earth. The pilot, it seems, has only seven seconds to work his controls and right his machine. Foreign machines, early in the war game, so corrected their functions as to allow the pilot 68 seconds to recover balance with his controls; that is to say, by correction of functions, the initial deviation time for doubling itself was increased from 7 to 68 seconds. The involuntary spiral dive is one of the greatest menaces to aviation.

"A second type of motion is called the 'Dutch roll,' from analogy to a figure in ice skating. The airplane takes up an oscillation in yaw and roll simultaneously. It swings to the right banking for a right turn, then swings back to the left banking for a left turn. The combined yaw and roll has a fairly rapid period. If heavily damped, this motion is made stable. At high speed the period is six seconds and an initial amplitude is damped to half value in less than two seconds. At low speed the period is 12 seconds, damped to half amplitude in six seconds. It appears from an approximate calculation that the Dutch roll may become unstable if an airplane has too much high fin surface, and if there is not sufficient weather helm, or rear fin surface. These conditions are the reverse of those of spiral instability. The conflicting nature of the requirements for stability in these two kinds of motion suggests that an airplane is unlikely ever to be unstable in each sense. It also indicates the difficulty of obtaining lateral stability by raised wing tips. Thus, our military machine was spirally unstable at high speed and stable with the Dutch roll. At low speed it was spirally stable and unstable with the Dutch roll. It is believed that the majority of airplanes of ordinary type are spirally unstable because of excess of fin surface aft. When attempts have been made to remedy this fault by use of a large dihedral angle upwards for the wings, matters have been made worse. It is only to be expected that in over-correcting spiral instability a Dutch roll of more or less violence may be introduced. Especially in gusty air would one expect high fin surface to produce violent rolling. Our experimental machine with a slight rise of wings, about 1.6 degrees, and a small rudder, has shown that at ordinary speeds it is stable in every sense, longitudinally and laterally, and that it is possible to secure a degree of stability in every airplane of conventional type. But whether this stability is excessive in turbulent air, per each particular machine, can only be determined by actual flight in it.

"If an airplane be unstable in still air it is obviously worse off in gusts. The converse is unfortunately not true, since it may be very stable in still air yet be so stiff that in turbulent air that it will be violently tossed about. It is conservative to conclude that airplanes should not be unstable and that they need not be, since slight changes in the nature of adjustments suffice to correct such instability of motion. With military planes inside the zone of fire, the probability of controls becoming inoperative is ever present. An inherently stable plane with controls abandoned or shot away, could still be operated by a skillful pilot by manipulation of motor power alone. Any sort of automatic or gyroscopic stabiliser which operates on the controls is of no use when those controls fail, and it should be judged only as an accessory to assist a pilot rather than as a cure-all for inherent instability of an airplane's motion. There is no use to seek radical changes of type to secure stability, when an ordinary type of plane lends itself to adjustments which make for inherent stability of motion. Freak airplanes of great stability may be excessively stable in some ways and frankly unstable in others. It is likely that the coming most satisfactory airplane may be only slightly stable, and that it will in any possible attitude be easily controlled by the pilot. Just such a machine was announced in press dispatches from London recently and called 'The Fool Killer.' Controlability and statical stability are to some extent incompatible. Dynamical stability requires some amount of statical stability and considerable damping. It appears to be of advantage to provide the minimum of statical stability and the minimum of damping. Then the airplane's motion will be of very long period but heavily damped. Full understanding may be had of the effect on the motion of each change, by a systematic variation of one feature of design at a time. The process is of necessity laborious, but compared with the difficulty of full-scale experiment in open air, the model method is rapid and inexpensive. It is rarely possible in actual flying to obtain any idea of the effect of slight changes in design. Weather conditions, motor troubles, personal peculiarities of pilots, etc., tend to add to complexity of an otherwise very simple problem."

"Experimental flying is dangerous. A pilot, to determine whether a new airplane was spirally unstable, took his machine up to a good altitude and allowed it to get into a spiral dive. The machine made five or six turns of rapidly widening and contracting helix before he could bring it out on a horizontal path. If the controls had been only a little less powerful, the machine would surely have crashed to the ground. That the controls were adequate was purely a matter of good fortune. The experiment was a success in that spiral instability was demonstrated. Only a few minutes of time was required, but no information was obtained as to the degree of instability present, nor what remedial changes

(Continued on page 128)



An improvised machine for shaping ship-plates

A Home-Made Machine for Cold Plate Bending

A YEAR or so ago a shipbuilding concern in Pensacola, Fla., which was rushing to completion a new plant, went into the open market in search of a set of cold bending rolls that would roll plates up to 30 feet in length. They found that the best they could do would be to pay about $50,000 for a set which could be delivered to them in 15 months or thereabouts; so it became necessary for them to devise some sort of a substitute for the conventional rolls. The result is the plate-bending machine illustrated herewith.

This machine consists of a structural frame with backing-up brackets and adjustable formers resting on a concrete foundation. The plates to be bent are placed on edge in the machine, between the brackets and the formers, as shown in the photograph. A series of chains attached to the structural frames passes over the end of the plate, thence over sheaves anchored to the end of the frame, and thence to the ends of the air and water cylinder pistons. If the plate is to be bent to a uniform radius, a master valve is opened which controls all the cylinders, and applies a uniform pull on all the chains. If it is desired to bend any portion of the plate more than others, the master valve remains out of action, and the appropriate individual valves go into operation. By raising or lowering or advancing or retarding the backing up brackets or the formers, the plates can be bent to any desired radius.

The machine thus developed met the emergency against which it was designed; for it cost about $15,000 and was ready for operation in less than three months.

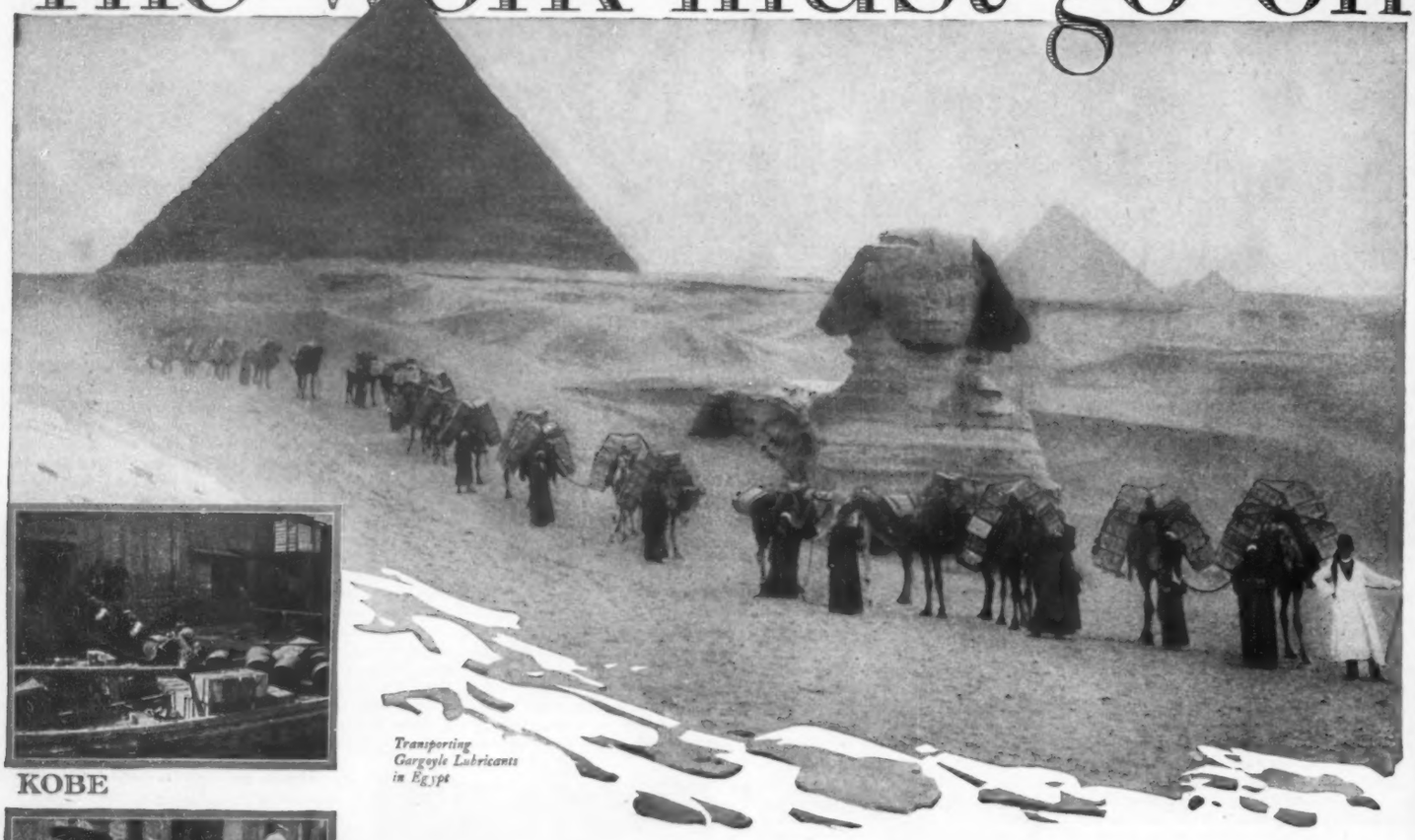
"Liberty Fuel"

A GOOD deal has appeared within the past few weeks upon the motor fuel invented by two army officers and the general tone of these notices, coupled with the suggestion of governmental acceptance carried by the name under which the new compound was announced, has led to a rather enthusiastic acceptance of the very broad claim that this fuel is soon to replace gasoline on a wide scale. It was not for a long time possible to get data on which to base intelligent comment; but press despatches of January 14th at last met this need.

It appears that some 65 per cent of the new fuel is benzol, while of the kerosene previously announced as its "base" there is present but 25 or 30 per cent. To anyone acquainted with the supply and demand for benzol, this puts the "Liberty Fuel" on the defensive at once. If all the benzol which we are now producing could go into its manufactures, it could not be made in sufficient quantity to replace more than two per cent of the gasoline which we now use.

Of course this does not mean that "Liberty Fuel" or something like it would not some day be a fine thing. But it does mean that for the present it is not to be thought of. Only by a complete revolution in the ways of getting benzol, and probably in the sources of supply as well, could a fuel containing 65 per cent of this substance become a commercial proposition. When to this is added the further circumstance that the inventors would not supply the Bureau of Standards with their formula for testing purposes, and that when the Fuel Administration finally got some of it for test it found several grave technical defects, it seems quite clear that the whole thing is more or less of a bubble.

The work must go on



Transporting Gargoyle Lubricants in Egypt

KOBE

SHANGHAI

JAVA

THE plows of Egypt are still being pulled by oxen. Able-bodied Hindus are carrying building materials on their backs. Progressive Japan still has jinrickshaws.

But labor grows scarce. Man-work must be diverted to fields where it can best serve. Muscle is fast losing the right to compete blindly with mechanical power.

Egypt is already taking up farm tractors. Motor-trucks must go to India. Japan will replace jinrickshaws with taxicabs.

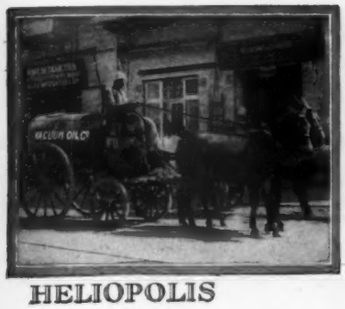
Wasteful methods are falling by the wayside. The age of machinery will not be denied. The work must go on.

SEOUL

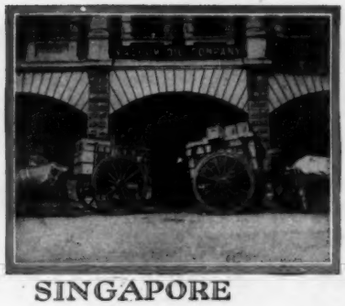
KOBE - JAPAN

CALCUTTA

SOERABAIA



HELIOPOLIS



SINGAPORE

THE age of machinery spreads outward from America. During the ten years ending 1916, nearly $1,150-000,000 worth of American machinery was shipped to all parts of the world.

In America alone, 125 leading manufacturers of power machinery specifically recommend or endorse the use of the Vacuum Oil Company's Gargoyle Lubricants to the purchasers of their equipment.

Vacuum Oil Company Branches and representatives dot the earth. Men serving under the red Gargoyle have taught unskilled Malays how to operate their American engines. Oriental and African misuse of lubricants has been corrected. The more intelligent peoples who lacked mechanical carefulness have become informed.

New inventions often bring new lubricating needs. As these needs arise they will be met by new Gargoyle Lubricants. To safeguard the correct operation of machinery going to all parts of the globe, the Vacuum Oil Company maintains an ever-expanding world organization.

The work must go on.

GARGOYLE

Lubricants

A grade for each type of service

VACUUM OIL COMPANY, New York, U. S. A.

Specialists in the manufacture of high-grade lubricants for every class of machinery. Obtainable everywhere in the world.

Domestic Branches: New York, Boston, Philadelphia, Pittsburgh, Detroit, Chicago, Minneapolis, Indianapolis, Kansas City, Kan., Des Moines

Correct
AUTOMOBILE LUBRICATION

GARGOYLE

Mobiloils

A grade for each type of motor

Gargoyle Mobiloil for engine lubrication are:

Gargoyle Mobiloil "A"
Gargoyle Mobiloil "B"
Gargoyle Mobiloil "E"
Gargoyle Mobiloil Arctic

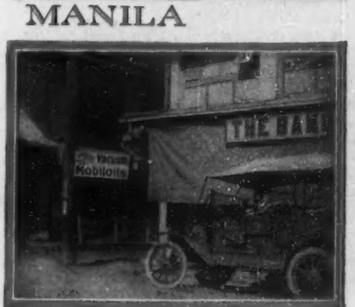
The Chart below indicates the grade recommended by the Vacuum Oil Company's Board of Engineers. The recommendations cover all models of both passenger and commercial vehicles unless otherwise noted. If your car is not listed in this partial Chart, send for booklet "Correct Lubrication" which lists the correct grades for *all* cars.

AUTOMOBILES	1918 Models Summer	1918 Models Winter	1917 Models Summer	1917 Models Winter	1916 Models Summer	1916 Models Winter	1915 Models Summer	1915 Models Winter	1914 Models Summer	1914 Models Winter
Abbott	Arc	Arc								
Abbott-Detroit			Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
" (8 cyl)					A	A	A	A		
Allen	A	Arc	A	Arc	A	Arc	A	Arc	A	A
Apperson	A	A	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
" (8 cyl)	A	A	A	A	A	A				
Auburn (4 cyl)					A	Arc	A	Arc	A	A
" (6 cyl)	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
" (6-38 & 6-39)			A	Arc	A	Arc				
" (6-39B) (Tower M)	A	Arc								
" (6-39B) (Cont'l)	Arc	Arc								
Autocar (2 cyl)	A	Arc	A	Arc	A	Arc	A	Arc	A	Arc
Brewster	A	Arc	A	Arc	A	Arc	A	Arc	A	Arc
" (8 cyl)					A	A				
Buick	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	A	Arc
Cadillac	A	A	A	A	A	A	Arc	Arc	Arc	Arc
Case	Arc	Arc	A	Arc	A	Arc	A	Arc	A	Arc
Chalmers	A	A			Arc	Arc	Arc	Arc	A	A
" (6-40)					A	Arc				
" (6-30)			A	A	A	A				
Chandler Six	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
Chevrolet	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	A	Arc
" (2 cyl)	A	A	A	A						
" (4 A)	A	Arc								
Cole	A	A	A	A	Arc	Arc	Arc	Arc	Arc	Arc
" (6 cyl)					A	A	A	Arc		
Cunningham							Arc	Arc	Arc	
" (8 cyl)	A	A	A	A	A	A				
Dart	A	Arc	A	Arc	A	Arc	Arc	Arc		A
" (Mod. C)			A	Arc	A	Arc	A	Arc	A	A
" (2 & 2½ ton)	A	A								
Detroiter	Arc	Arc	Arc	Arc	Arc	Arc	A	Arc	A	A
Dodge Brothers	A	Arc	A	Arc	A	Arc	E	E		
Dort	A	Arc	A	Arc	A	Arc	A	Arc		
Empire (4 cyl)	A	Arc	A	Arc	A	Arc	Arc	Arc	Arc	Arc
" (8 cyl)	Arc	Arc	Arc	Arc	Arc	Arc				
Federal	A	A	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
" (Mod. S-X)	A	A	A	A						
" (Special)	Arc	Arc								
Flint	B	A	B	A	B	A	B	A	B	A
Ford	E	E	E	E	E	E	E	E	E	E
Franklin	A	A	A	A	A	A	A	A	A	A
Grant	A	Arc	A	Arc	A	Arc	Arc	Arc	Arc	Arc
Hal Twelve			A	A	A	A				
Haynes	A	Arc	A	Arc	A	Arc	A	Arc	A	Arc
" (12 cyl)	A	A	A	A	A	A				
Heller (6 cyl)	A	Arc	A	Arc						
" (8 cyl)	A	A	A	A	A	A	A			
Hudson					Arc	Arc	Arc	Arc	Arc	Arc
" (Super Six)	A	Arc	A	Arc	A	A				
Hupmobile	A	Arc	A	Arc	A	Arc	A	Arc	A	Arc
Jackson			Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
" (8 cyl)	A	A	A	A	A	A				
Jordan	Arc	Arc	Arc	Arc						
Kelly Springfield	A	A	A	A	A	A	A	A	A	A
King							A	Arc	A	A
" (8 cyl)	A	A	A	A	A	A	Arc	Arc		
" (Cont'l)	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
Kissel Kar	A	Arc	A	Arc	A	Arc	A	Arc	A	Arc
" (Mod. 48)					A	A	A	A	A	A
" (12 cyl)	A	A	A	A						
Lexington	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc		
Liberty (Detroit)	Arc	Arc	Arc	Arc						
Lippard Stewart	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
" (Mod. M)			A	Arc	A	Arc				
" (Mod. MW)			A	Arc						
Locomobile	A	E	E	E	E	E	E	E	E	E
McFarlan	A	Arc	A	Arc	A	A	A	Arc	A	A
Madison	A	Arc	A	Arc	A	Arc	A	Arc		
" (8 cyl)			A	A	A	A				
Marmon	A	A	A	A	A	A	A	Arc	A	Arc
Maxwell	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
Mercer	A	A	A	A	A	A	A	Arc	A	Arc
" (35-70)							Arc	Arc		
Mitchell	A	Arc	A	Arc	A	Arc	A	Arc	A	Arc
" (8 cyl)					A	A				
Moline-Knight	B	A	A	A	A	A	A	A	A	A
National	Arc	Arc	Arc	A	Arc	Arc	A	Arc	A	A
" (12 cyl)	A	A	A	A	A	A				
Oakland	A	A	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
" (8 cyl)				A	A	A				
Oldsmobile	A	A			Arc	Arc	Arc	Arc	Arc	Arc
" (6 cyl)	A	A	A	A	A	A				
Overland	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
Owen Magnetic	A	Arc	A	Arc	A	Arc				
" (Mod. M15)	Arc	Arc	Arc	Arc						
Packard							A	Arc	A	Arc
" (12 cyl)	A	A	A	A	A	A				
" (Cont'l)	A	A	A	A	A	A	A	Arc	Arc	Arc
Paige (4 cyl)							A	Arc	A	A
" (6 cyl)	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc		
" (6-36)					A	Arc	A	Arc		
" (6-36-39)			A	Arc						
" (6-40)	A	Arc								
Paterson	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc		
Pathfinder			Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
" (12 cyl)			A	A	A	A				
Peerless	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
" (8 cyl)	A	A	A	A	A	A				
Pierce Arrow	A	A	A	A	A	A	Arc	Arc	Arc	Arc
" (Cont'l)	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
Premier	A	A	A	A	A	A	A	Arc	A	Arc
Regal	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
" (8 cyl)					A	A	Arc	Arc		
Renault (French)							A	Arc	A	Arc
Reo	A	Arc	A	Arc	A	Arc	A	Arc	A	Arc
Riker	E	E	E	E	E	E	E	E	E	E
Saxon	E	E	E	E	E	E	E	E	E	E
Sebring	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
" (16 valve)			A	Arc						
Simplex			A	A	A	A	A	A	A	A
Stearns-Knight	B	A	A	A	B	A	B	A	B	A
" (8 cyl)	B	A	A	A	B	A				
Studebaker	A	Arc	A	Arc	A	Arc	Arc	Arc	A	Arc
Stutz	A	A	A	A	A	A	A	A	A	A
Velie (4 cyl)							A	Arc	A	Arc
" (6 cyl)	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
" (2 & 3½ ton)	Arc	Arc								
" (1½ ton)	A	Arc								
Westcott	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
White	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
" (16 valve)	A	A	A	A						
Willys-Knight	B	A	A	A	B	A	B	A	A	A
Willys Six	Arc	Arc	Arc	Arc						
Winton	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc

CAIRO

PORTUGAL

MANILA



BANGKOK

WELLINGTON *New Zealand*

BOMBAY

FUNCHAL—MADEIRA

BOMBAY

Mechanical Equipment of the Farm

Latest developments in agricultural machinery and practical suggestions for the farmer

Conducted by HARRY C. RAMSOWER, Professor of Agricultural Engineering, Ohio State University

A farm tractor with broad, cleated wheels for field work and rubber-tired wheels for service on roads

A Rubber-Tired Tractor

THERE seems to be no lack of new ideas in the development of farm tractors. Road work with a tractor, while much faster than team work, has seemed to many to be rather slow. Speeds of from 3½ to 4½ miles per hour are about all average tractors make. With the regulation wheels equipped with lugs it is perhaps not wise to run a tractor on the road faster than this because all parts would be subjected to too much jar and strain.

A prominent eastern company has solved this probelm by providing one set of regulation wheels for heavy traction work and another set of rubber-tired wheels for road work. The change from one set of wheels to the other is easily and quickly made. With the rubber-tired wheels a speed of ten miles an hour is possible and the wear and tear on the machine is reduced to a minimum. Of course, there are some drawbacks to such a combination as, for example, the additional cost of the extra wheels. To balance this, however, is the fact that with much hauling to be done a remarkable saving in time would be effected in the course of a few years.

Aside from the road wheel feature this machine is a real tractor. It is built on neat, attractive lines and material of good quality seems to have gone into its making. It is equipped with a four-cylinder motor 4 inches by 6 inches, weighs 3,850 pounds, and is given a rating of 12-24 horse-power. It seems to handle a three-bottom plow in a very satisfactory way.

One feature of especial note is the convenient and comfortable seat for the driver. The awkward, uncomfortable position which the driver must assume on many tractors constitutes an everlasting objection to them. On some machines the driver must sit straddle of the motor or frame and cannot easily change his position. To sit in such a manner for several hours at a stretch is tiresome to say the least. The driver, too, is quite well protected by the very ample guards from the dust and dirt thrown up in the field by the traction wheels, a feature well worth considering in the purchase of a tractor.

Keeping Farm Roads Fit

THE roads and lanes on the average farm fall into a more or less disreputable condition during the winter and spring months, making passage over them for teams or stock difficult and disagreeable. In a large part, neglect is responsible for this condition. It is quite possible to make a good road out of earth and keep it good. A good road, like a good house, must have a good roof and a dry cellar. Adequate underdrainage by way of a line of tile on one or both sides of the road will provide the dry cellar; and a smooth surface with good crown constitutes the roof.

Using a grader for open ditch work

The grader, or terracing machine, shown on this page, is inexpensive and yet effective in grading up the road. When drawn by four or six horses, a mile of road can be graded quickly and well. Once graded it will be necessary only to go over the road after heavy rains, to fill up stock and wagon tracks, and rub off high spots so that water may not stand on the surface. A split-log drag, or one made of planks, will accomplish the same purpose, after the proper crown is secured.

The particular machine shown is quite a remarkable tool for digging or cleaning out old open ditches. It will pay for itself many times over for this work alone. It is also used in some cases for digging trenches for drain tile.

The road grader drawn by a tractor, shown on this page, represents an interesting combination. A 30-foot roadway is completely covered in a single operation. Several miles of road can be "touched up" in one day with such a rig. The tractor is doing the work of 24 horses and six men.

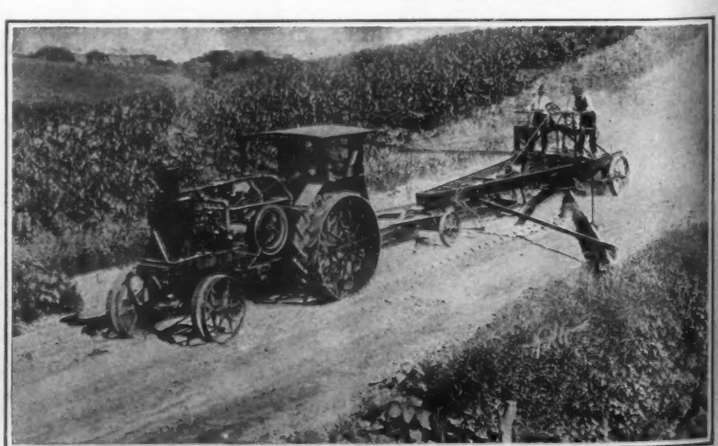
Lack of Equipment in the Farm Kitchen

THE statement that the American people have been much more tardy in the purchase of modern, labor-saving equipment for the farm home than they have for the farm proper and for the barn cannot be successfully contradicted. The sickle has been replaced successively by the cradle, the self rake, and the binder, but the old stone churn with its complement of milk pans, the coal-oil lamp, the well sweep, still persist in surprising numbers. It should not be said that such order of development was not to be desired, for it will be readily admitted that a successful, satisfactory farm home cannot be built on other than a fertile, well kept soil which produces high-yielding crops and thrifty stock. For 50 years we have had the gospel of better soils, better crops, better live stock, better management preached from the lecture platform and spread by the press, but in all this time we have had but few champions of the better equipped farm house.

One reason for the lack of equipment in the

(*Continued on page 128*)

The machine above used as a road grader

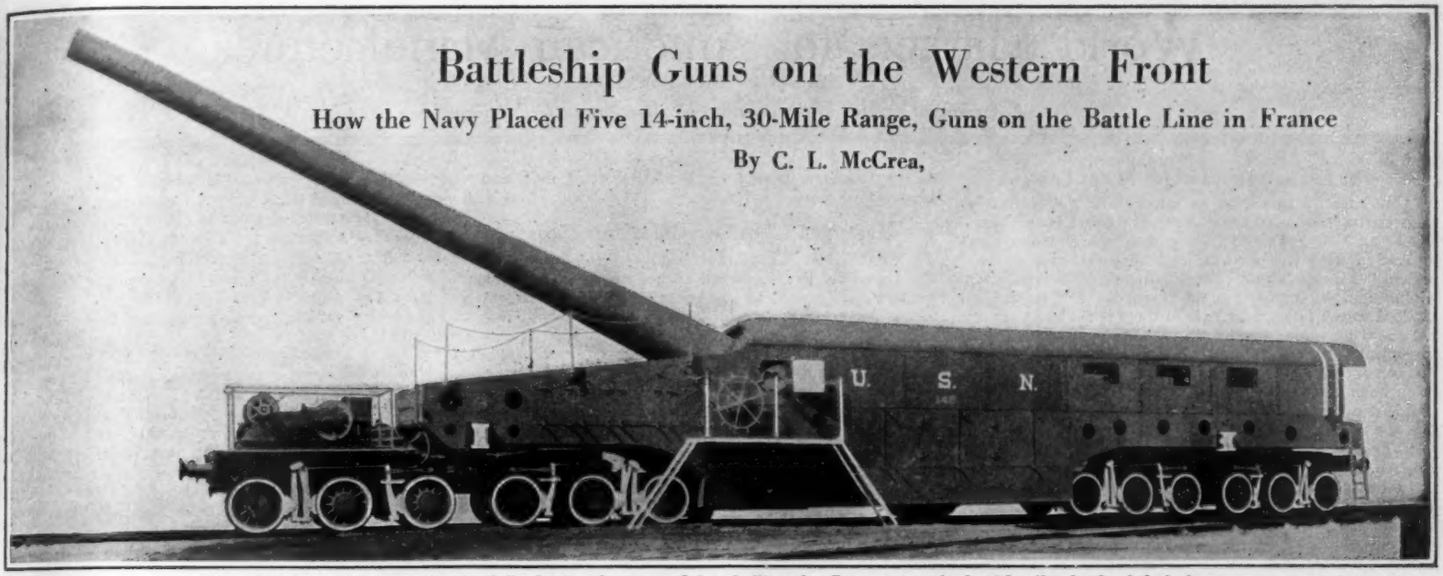


A 25-50 tractor grading a 30-foot road in a single operation

Battleship Guns on the Western Front

How the Navy Placed Five 14-inch, 30-Mile Range, Guns on the Battle Line in France

By C. L. McCrea,



The 14-inch naval gun, on its specially designed car, used for shelling the German terrain for 30 miles back of their front

DURING the closing days of the year 1917, ordnance experts of the U. S. Navy, who had been closely watching the trend of events in the great war, became intensely interested in the effect of long range bombardments. At a point about 28 miles from Dunkirk, the Germans had placed a large naval gun which opened fire upon that city, causing great damage, while at other points similar naval guns were carrying on their destructive work. It was reported that the Germans regarded long range bombardments as of such primary importance that they had dismantled several of their older battleships in order to bring the guns from them into action on the western front. This tendency to increase the range of guns is demonstrated by the German innovation of a gun with a range of 75 miles, which fired a light projectile on the city of Paris (sometimes hitting that city—more often not).

While the Navy's limited testing facilities—*i. e.*, proving ground with a range of only 18,000 yards—had never permitted the firing of its big guns at high angles of elevation, it was felt that the 14-inch 50-caliber naval rifle was superior to any German gun built, in range, accuracy, and striking power.

The 14-inch naval gun throws a 1,400-pound projectile at a muzzle velocity of 2,800 feet per second. With the Navy type of shell its maximum range is well over 40,000 yards or 22 miles, while using a special shell, designed for firing at extreme ranges, a range of about 53,000 yards or 29½ miles was possible.

Areas for destruction not hitherto touched were opened to a gun of this range. Troop centers, lines of communication, railroads, reserve store houses, and similar strategic points almost too numerous to mention could be destroyed by such guns. If mounted so that they could move rapidly from target to target, their possibilities were almost unlimited. Guns of this type were urgently needed. Rear Admiral Ralph Earle, Chief of the Navy Bureau of Ordnance, recognized that need and saw that if a battery of 14-inch guns could be placed in action on the fighting front in France by the summer of 1918, they could render a real service to the armies.

It was decided that the emergency was such as to warrant using guns for this purpose that were intended for replacing damaged guns of the Fleet. Risks had to be shouldered in making this decision, but in time of war and need, responsibilities are heavy in all matters. It was, therefore, proposed to build mobile mounts for the guns (which meant railway mounts, for in no other way could the 95-ton, 14-inch gun be transported), completely equip them and place them in action in France before the close of the summer fighting in 1918.

In less than 30 days, complete designs were prepared which called for a battery of five guns, each gun car train to be provided with a locomotive for hauling it, two ammunition cars, three berthing cars to house the operating personnel, a crane car, flat cars and gondola cars for carrying material, as well as other auxiliary cars. In addition to the five-gun car trains, a sixth train was provided to go independently from one gun position to another. The equipment totalled five gun cars, six locomotives, and 72 cars.

The gun car consists of two large bridge girders, tied into a single unit, 72 feet long and weighing 68 tons. In the well between the two girders is mounted the 14-inch naval gun, which with yoke and breech mechanism weighs 95 tons, and the 30-ton gun slide, in which the gun moves back during recoil. The hydraulic recoil brake and the counter recoil mechanism are attached to the gun slide. The entire unit, consisting of girders, gun, slide, elevating gear, etc., is mounted on two sets of 12-wheeled trucks. The gun is arranged to fire at angles of elevation up to 15 degrees directly from the rails, and from a special steel and timber foundation at higher angles up to the maximum, 45 degrees. This foundation is prepared at the firing point in advance of the arrival of the gun car. The gun car is rolled over it and the foundation adjusted until the entire weight of the gun car is carried by it.

Aiming is accomplished when firing from the rails by the use of a curved track. A simple traversing gear is provided to enable the gun to be aimed when it is on the pit foundation.

Every item went forward exactly as planned. Construction was pushed to the limit and all speed records were broken. The first mount was completed on April 25th, 1918—just 72 days from the date the contract was signed—120 days from the date the designs were first started. This mount was proved at Sandy Hook, N. J., on April 30th, 1918, where it met every test most successfully. June 1st, 1918, saw the complete fulfillment of the first phase of the project; the Naval Railway Batteries were ready for shipment.

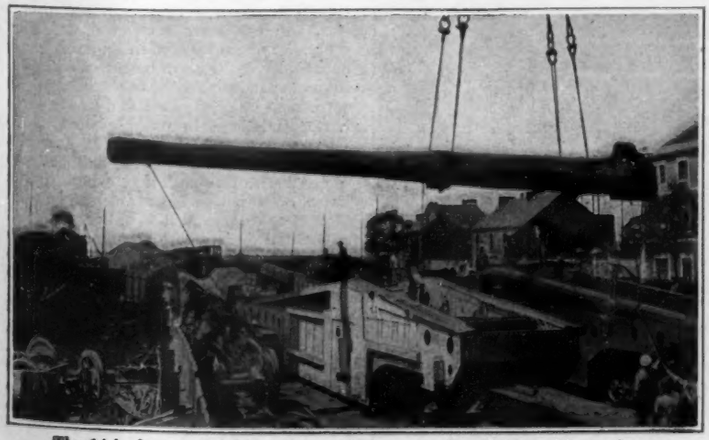
A slight delay occurred in the shipment of the batteries to France, for the German submarine U-151 which was operating off our coast seemed to be especially anxious to prevent the shipment of the material. The submarine danger, however, was soon overcome, and by July 4th, 1918, practically all the material was en route to St. Nazaire, France, where an erecting gang of American Bluejackets was eagerly waiting to put the guns together and get them into action. The French, too, were just as eager to get the guns into action, so work on the assembly of gun cars No. 1 and No. 2, and their trains, was rushed, and they left for the front on August 17th and 18th, respectively.

After a short trial trip over the railroads of France, and some preliminary tests, these guns were rushed to Laon, where, under the direction of the 10th French Army, they fired their first shots against the Germans on September 6th, 1918—nine months and ten days from the date on which work was started.

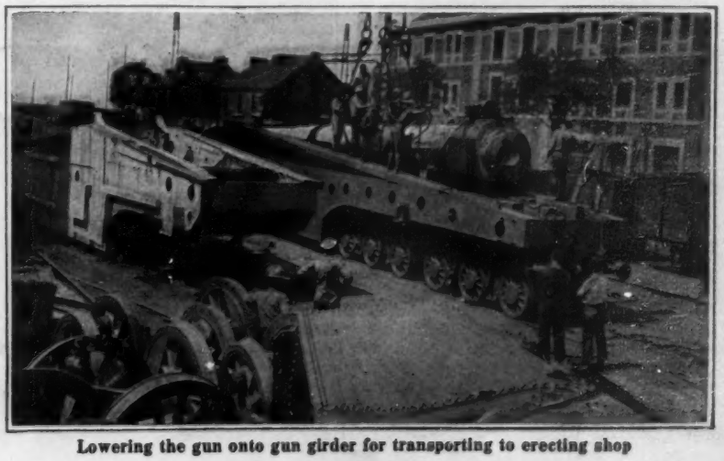
At Laon the guns inflicted great damage, their crowning achievement being the destruction of a crowded German moving picture theater. One 1,400-pound shell hit the theater leaving nothing but a deep crater in the ground, marked by scattered debris and identification tags of former occupants of the building.

Gun trains No. 3, No. 4, and No. 5, and the staff train,

(Continued on page 129)



The 14-inch gun, weighing 95 tons, being transferred from ship to shore



Lowering the gun onto gun girder for transporting to erecting shop

World Markets for American Manufactures

Edited by LYNN W. MEEKINS

A department devoted to the extension of American trade in foreign lands

Far Eastern Demand for Motor Cars

"THE man who drives an automobile through such traffic jams as one finds at the intersections of busy streets in New York and Chicago has little to worry him compared with the operator of a motor vehicle in the Orient," said an automobile exportman recently. "In China and in Japan, the good roads are practically limited to the large cities, where there is such a mass of slow moving vehicles and pedestrians that it is hard work sometimes to pass a snail. Although the rural visitor to New York may jump half way out of his shoes when the piercing sound of a motor horn strikes his ear, the resident of Tokio pays no attention to such sounds—he has the right of way.

"For city use in Japan, the closed car is preferred, chiefly because the Japanese lady doesn't wear a hat. Her hair has been painstakingly combed and she shuns a breeze. Other features favoring the closed car in Tokio are the clouds of dust in summer. Not that open cars have no sale. They meet the demand for country travel and are popular with the foreign residents."

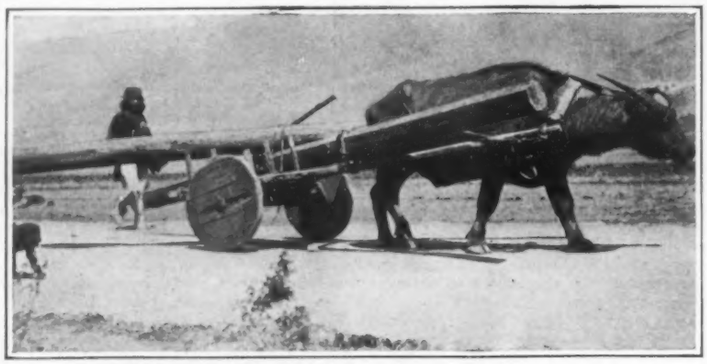
With more than $1,250,000,000 capital invested, the American automobile industry is second only to steel in the manufacturing field. Export business is vitally necessary for its continued prosperity, and there is a steady increase in the number of motor companies entering foreign fields. One of the best known manufacturers in this line is conducting a scientific sales campaign that is placing his products in the world's most profitable markets. He is sending high-calibered representatives to make systematic studies of the needs of his prospective customers. These men are supplied before they leave the United States with all the information that is obtainable here. They start out with a fair knowledge of general conditions in the countries to be visited, with particular emphasis upon road systems, fuel costs and the purchasing power of the people. The motor vehicle has to have something more than a footpath to travel over; gasoline, or an equally efficient fuel, to keep it going; and a regular expenditure to maintain it.

Where Favorable Conditions Prevail

Good roads and prosperity usually go together in the Orient as well as in other parts of the world. They are found especially in the Philippines, the Straits Settlements, the Federated Malay States and the Dutch East Indies. Last year the Philippines enjoyed the largest trade in their history. The natives are the principal buyers of motor cars, and they prefer small, lower-priced machines. In Manila most of the establishments that used to keep horses and vehicles for hire now maintain motor cars for rent by the hour. A motor bus line is projected, and if fuel costs do not decrease, the company operating these busses will import gasoline from the United States in its own sailing vessels.

There are more than 3,000 miles of improved roads in the Straits Settlements and in the Federated Malay States. This region is well off financially because its raw materials—mainly rubber and tin—were needed for war purposes, and they are also important in time of peace. Purchasers of automobiles (and this statement applies equally to buyers in the Dutch East Indies) are interested in cars of the better grades. Freight rates to these countries are high, and the man who buys an automobile thinks he might as will have a good one, because a considerable part of his investment is spent on transporting the machine from the United States.

Manila is a good distributing point not only for the Philippines but for much of the Orient. The manufacturer introducing his car into Malaysia should concentrate his efforts in Singapore. Batavia and Soerabaya are the principal ports of entry in the Dutch East Indies. The motor car business in other Far Eastern countries is centered in Shanghai for China; Tokio for Japan; Calcutta, Bombay and Madras for India; and Bangkok for Siam.



Transporting timber in the ancient fashion

Argentina Likes Our Office Furniture

"AMERICAN manufacturers of office equipment have firmly established themselves in the Argentine market," writes an American representative from Buenos Aires. "They have the reputation of designing the most practical and the most efficient type, and as yet no European manufacturer has been able to offer a style that is so well liked. In the year preceding the war, Argentine spent at least $750,000 for American office furniture and for chairs to be used in theaters and schools. Just before the war broke out, there was a financial crisis that hindered sales, but the country has become prosperous since then, and furniture dealers have disposed of most of their stocks. Now there is a shortage.

"American desks are so popular in Argentina that few business men will have any others. Low roll-top desks are preferred to those of extremely high style. It is most profitable to import desks of medium to good grade, because the duty and the freight rates are no higher than than they are on cheaper kinds, for which there is not so large a sale."

American Chairs in Demand

According to a chair manufacturer who has received many orders from Buenos Aires and other Argentine cities, the largest call is for cheap chairs known as the Grecian type, which are decorated with stenciled designs. The Argentine market absorbed nearly 50,000 of these chairs monthly before the war. The finishes preferred are natural wood and dark oak. It is advisable to give them a good coat of varnish and pack them "knocked down," one dozen in a box. They are subject to a duty of six pesos ($2.52) per dozen. It is said by a man familiar with the Argentine furniture market that a hundred suites consisting of four chairs, two armchairs and one sofa, for use in offices and waiting rooms, can be sold monthly. The chair included in such suites is of medium grade with a fan-shaped back, quartered oak finish and a closely woven cane seat. The duty levied on this type of chair is about 25 pesos ($24.12) per dozen. Almost every office in Argentina contains one or more American swivel chairs. Under normal conditions probably three hundred dozen per month can be sold.

The education of Argentina office assistants in the intelligent use of modern time- and labor-saving devices will largely increase the sales of American correspondence files and card index systems, which already have been successfully introduced. If manufacturers of American office furniture would equip free of charge some of the commercial schools maintained by the Argentine Government, and provide a well-trained instructor to teach the use of modern office facilities, the investment would be likely to yield substantial returns.

Sectional bookcases are good sellers in Argentina. It is important that the bottom section should be provided with wooden doors to conceal the paper covered books, which become ragged and soiled from constant use. The size desired for this section is a depth of from 16 to 18 inches and a similar height.

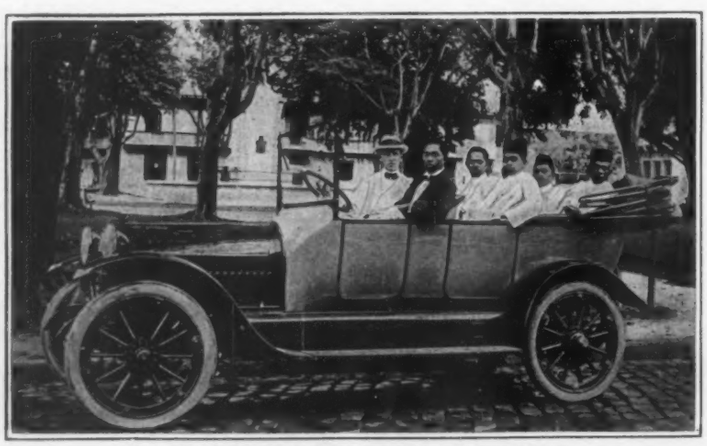
Because at present price counts more heavily than quality in Argentina, the sale of steel office furniture will be somewhat restricted. Although prices are very high, there seems to be a continual demand for steel files and card index cases. A well-directed campaign should place in railway offices, banks, commercial houses, libraries, and Government buildings the modern equipment that they now lack.

How to Increase Our Sales

"The American furniture manufacturer must keep three things in mind if he wishes to build up a profitable business in Argentina," said a visitor from Rosario. "He should standardize equipment, making fewer changes in dimensions and styles. Some time ago, I bought some correspondence files with the understanding that more of the same kind were obtainable when desired. Naturally it was considerably annoying to be told later that a newer style had replaced the variety that I had bought. The lack of uniformity in color limits the sale of American furniture. The golden quartered-oak finish is the most popular in Argentina, and all kinds of office equipment should be in the same shade of that color. It is sometimes difficult to match desks and chairs with bookcases and other equipment. Your manufacturers should settle upon definite styles of golden oak, light or dark.

"Then as to packing. Shipments from the United States are well boxed, but there is too little economy of space. I know of one consignment that created a freight bill of several hundred dollars more than was necessary. Sanitary bases for sectional bookcases were shipped set up in a box, and under separate cover were sent a number of empty card-index boxes which could very easily have been packed in the unused space within the bases. As freight rates were then $1 per cubic foot, a little better judgment in packing would have effected a large saving. It does not seem possible to emphasize sufficiently to the American packer that export freight rates, especially to Latin America, quite as often are a matter of space occupied as of actual weight. In moving stuff by rail express into the next state, the tariff may be based on weight alone; but a ship can't hitch on an extra car or two to accommodate waste space, and must accordingly charge for that space."

It would seem that Argentina offers a sufficiently attractive field for American manufacturers to sell office equipment there through their own representatives. Thus far, however, American lines have been handled entirely by foreign agents, who carry in many cases competing products. We can dispose of our goods more successfully by Americanizing the distribution.



The Sultan of Sulu and his staff in an American car

BOSTON to BOSTON
Via San Francisco and Los Angeles

TWO Goodyear motor trucks, shod with Goodyear Pneumatic Cord Truck Tires, recently carried full loads from Boston to San Francisco and returned to Boston by way of Los Angeles.

They were taken off their regular Akron-to-Boston route without special preparation and sent west.

As shown by the recordograph, they completed the 7,763-mile round trip in 24 days, 1 hour and 55 minutes of actual running.

The journey constituted a remarkable demonstration of the ability of motor trucks, equipped with Goodyear Pneumatic Cord Truck Tires, to negotiate the worst kinds of going found anywhere.

For 71.5 per cent of this transcontinental jaunt was made over unimproved roads and in wagon trails.

The traction of the big Goodyear Pneumatics enabled the heavy trucks to negotiate mud, sand and grades that would have stalled solid tires.

This memorable performance of these pioneering Goodyear Pneumatic Cord Truck Tires points to their immense advantages for both highway hauling and off-the-road work.

THE GOODYEAR TIRE & RUBBER COMPANY, AKRON, OHIO

GOODYEAR
AKRON

Inventions New and Interesting

A Department Devoted to Pioneer Work in the Arts

Copyright, Press Illustrating Service

Making the most of the bicycle during winter months

When the Bicycle Becomes an Ice-Boat

WHY leave the bicycle idle in the cellar during the winter months? When the roads are covered with snow, the bicycle can be turned into a temporary ice-boat and used on frozen ponds and rivers. At least that is what occurred to a Brooklynite, and he set to work to prove his assertions.

The bicycle can be readily converted into a serviceable ice-boat by removing the front wheel and using in its place some form of frame resting on a pair of skates. In this case the Brooklynite arranged the frame with two small seats, so that he could ride about with two youngsters for company's sake. Using a non-skid tire on the rear wheel, it is possible to attain considerable speed with a vehicle of this kind; and in the absence of a non-skid tire, a bit of adhesive tape at regular intervals along the tire serves the purpose of better traction.

A Saw That Is Different

THE saw herewith illustrated, and recently placed on the market by a Newark manufacturer, consists of two steel arms actuated by a powerful connecting spring and crossing at the other end through a slide. Brackets are fastened to each of the flat ends, to which the blades (or plain pressure bars) are attached. These brackets are so made that the blades can be fitted with teeth in or with teeth out, and at any place on the flat end of the frame. Accordingly the outfit is extraordinarily flexible, and can be adjusted with great exactness to the particular size and position of the tree or lumber to be cut. Two blades can be used, cutting against one another like the blades of a pair of scissors, or a single blade opposed by a plain pressure bar, as illustrated.

When starting the blades, or blade and bar, are spread against the resistance of the spring, so as to straddle the tree or log. The machine is then simply worked back and forward, all the necessary pressure being furnished by the spring, whose tension is balanced by the compensating spring acting through the hollow bar attached to the arm. Owing to the action of this compensating spring, it is unnecessary to adjust the position of the brackets on the bars for any small or medium timber.

The great advantage claimed for this outfit is not alone in the great decrease of elbow-grease which it requires—a decrease so great that a child can cut the heaviest trees or timbers, according to the makers. In addition to this, there is to be considered the great convenience of being able to apply the saw wherever desired. One can stoop over and cut a tree flush with the ground; one can insert the blade under a prostrate log and cut the latter regardless of its position; one can stand on a limb and sever another limb, above or below; in fact the saw can be used in all sorts of places where it would not be possible to employ the ordinary cross-cut blade. Government tests indicate that one man with this saw can work to better effect than two men with the ordinary cross-cut saw.

A Decorticating Machine for Flax

EXPERTS in the preparation of flax have recently had their attention drawn to an invention of Mr. A. L. Spalding, of Dundee, Scotland, which, according to the claims made for it, can perform in a few hours all the processes of preparation from the time the flax is pulled from the ground until it is in a state for manufacture. The significance of these claims is made sufficiently clear by the statement that under present technique this preparation consumes weeks of time and a great volume of labor.

For centuries scientists and mechanics have been experimenting in the effort to simplify and improve the process of retting, but progress has been so slow that if Pliny were to return, he would recognize present methods as substantially identical with those described by him as employed by the Egyptians, the flax magnates of his day. After the rippling comes the steeping, the plant being placed in a large receptacle filled with water and covered with straw and stones. A fermentation is here set up, requiring the nicest care to avoid over- or under-retting. Then the flax is taken out and dried, broken, scutched and hackled.

All this requires from two to four weeks. But by the Spalding process the reeds are taken from the field and put directly through the decorticating machine, which takes off the seed and prepares the shove. The material is then scutched, the gum extracted, and it is ready for manufacture. It is said that the whole process consumes fewer hours than the present one does weeks. In addition, Mr. Spalding claims that his process would save an enormous quantity of straw which is now burned or put back in the ground, as well as of gum and shoves, which at present are obtained only in a very unworkable state.

Dundee experts who have examined the apparatus and tested the material which it turns out are very favorably impressed by the results, and some maintain that if properly developed, the machine should revolutionize the whole flax industry. Others, while freely conceding the value of the processes which have been discovered here, are in doubt as to their success on a practical commercial scale. In any event, the future development of the invention will be watched with the greatest of interest.

Copyright, Underwood & Underwood

Orchestra leader following the movements of the players by means of a periscope

A Periscope for the Musical Director

AT the mention of periscopes one might naturally assume that this is another war article. Periscopes are generally associated with military or naval warfare. But in this case the periscope is far removed from warfare; this is a story of a little ingenuity applied to music and the theater.

Herbert E. Hyde, composer and member of the Chicago Symphony Orchestra, came to New York city some time ago to direct his own music at the premiere of two well-known plays. To his dismay, however, it was discovered that the orchestra pit in the theater was under the stage, yet the demands of one of the plays—a pantomine—required that Mr. Hyde watch the stage and direct his orchestra so that the music would synchronize exactly with the movements of the actors.

The difficulty was finally solved by the use of a trench periscope, permitting Mr. Hyde to follow the movements of the players from his director's seat under the stage. The periscope shown is an exact copy of the historic one which Capt. Bairnsfather supplied for his soldier musical comedy, "The Better 'Ole."

A one-man saw that lends ease and speed to wood-cutting work

Recent Patent Decisions

Operativeness.—A prior patent for a machine, although the machine may not be practically operative, may operate as a prior publication, which will invalidate a subsequent patent to another, which embodies the same principle in an operative machine. There is a presumption from the grant of separate letters patent for two improvements on the prior art, but there is a specific difference between the inventions. As against complainant in an infringement suit, the presumption of utility of the machine of a prior patent is greatly strengthened by the fact that complainant for many years represented it to be useful, and the machine of a patent relied on as an anticipation is not to be deemed inoperative if it can be made to work by a slight alteration.—*Dalton Adding Mach. Co. v. Rockford Milling Mch. Co. U. S. D. C. of Ill.*

Patentable Designs.—A design, to be patentable, must disclose originality and the exercise of the inventive faculty, but invention may reside in a new combination of old elements, such as to give a new and an ornamental effect.—*Knapp v. Will & Baumer Co. U.S.D.C. of N.Y.*

Improvement on Another's Patent.—If a defendant appropriates a patented invention and improves upon it and obtains a patent, his patent gives him an exclusive right to the improvement, but no right to use the invention of the prior patent.—*Knapp v. Will & Baumer Co. U. S. D. C. of N. Y.*

Scope of Infringement Decree.—One not a party to an infringement suit.

(Continued on page 130)

A Boiler Preserver Which Eliminates Boiler Troubles

IN this advanced day there seems to be little excuse for boiler troubles. At least one boiler preserver is now in use which is claimed to eliminate all boiler troubles. In fact, the formula for the mixture has been in continuous use for the past 30 years, and the boilers of the plant where the formula was first tried out are still in service and treated regularly. The original tubes are apparently as good as new, and no boiler repairs have ever been made or found necessary. At all times the boilers are practically free from scale.

The remarkable feature of the boiler preserver in question is that the chemical formula has proved satisfactory in every kind of boiler feed water thus far tried, and particularly so with well water used for boilers. The chemicals used do not injure steel, cast iron, brass, copper, rubber, glass, valves and packing. The composition prevents pitting, removes boiler scale gradually, and prevents the formation of new scale. It will not carry over with the steam, and does not interfere in any way with the lubrication of steam cylinder and other equipment, where the lubricant is fed directly into the steam flow.

The boiler preserver referred to has stood for six months in wooden barrels without injury to the latter, indicating its harmless nature. A gallon of this preserver weighs about 9⅛ pounds, and the quantity generally prescribed for boiler use is two gallons per week for every 125 horse-power of boiler capacity. It is generally fed into the boilers through the boiler feed pipe.

The Current Supplement

INDIA is a land of mystery to most of us, and the customs and manners of the Hindu are difficult of understanding by most Occidentals. An article in the current issue of the SCIENTIFIC AMERICAN SUPPLEMENT, No. 2249, for February 8th, on *Some Aspects of Hindu Life in India* deals particularly with the family life, and draws a picture that is intensely interesting and which will be read with pleasure as it is written by a native who thoroughly understands the intricacies of his subject. *The Hero Shrew* describes and illustrates one of the most curious animals known. The series of papers on *Anomalies in Animal Life* is concluded in this issue, the present instalment treating of the invertebrates. *Transportation on the Magdalena River, Colombia*, gives a very interesting account of methods in an important district in South America of considerable commercial promise. The paper on *The Role of Selection in Evolution* is concluded in this issue. *The Detection of "Ghosts" in Prisms* is a scientific discussion of an important problem in the construction of optical instruments, and is accompanied by many explanatory diagrams. *Photographs on Salted Paper* gives instructions for the preparation of a material which enables the production of an extremely wide variety of effects and gives most beautiful results. Other articles in this issue are *A South Carolina Meteor, Discoloration of White Paint* and *Action of a-Rays on Metals.*

The Instability of American Airplanes

(*Continued from page 119*)

were necessary. To complete the experiment, it would be necessary to repeat the dangerous feat for every change which suggested itself. Naturally, a designer will be very economical in his suggestions under such conditions.

"The Bleriot monoplane has only a small rolling moment due to side slip, is stable on the Dutch roll and only slightly unstable in spiral motion. The spiral motion is a slow divergence which doubles itself in 68 seconds. This is an extremely slow change and should give no trouble to the pilot. The well-known steadiness of this airplane is in full agreement with our theoretical conclusions. The Bleriot makes no claim to lateral stability, but is essentially steady and easily controlled. In the Dutch roll the Bleriot is strongly damped and hence very stable. The spiral motion is not damped, but so slow that the stability may be called neutral. The aim of the French school has always been a machine whose lateral stability is neutral so that it will not be thrown about by the wind. If we turn to practical aviation in the war area, we observe that the airplanes which are noted for their steadiness at low speeds are the light Antoinette, Farman, various Taubes derived from Etrich, etc. These planes have a large wing area and light loading, probably three and four pounds per square foot. The light loading enables the planes to gain a safe low speed without having the angle of incidence near the angle of maximum lift.

"An airplane in flight has six degrees of freedom, three of translation and three of rotation. Any study of its behavior must be based on the determination of three forces—vertical, transverse and longitudinal, as well as couples about the three axes in space. The use of a wind tunnel in experiments was based on the assumption that it is immaterial whether the model moved through still air or was held stationary in a current of air of the same velocity. The principle of relative velocity is fundamental, and the experimental discrepancies between the results of tests conducted by the two methods may be ascribed on the one hand to the effect of the moving carriage on the flow of air about the model and to the effect of gusty air, and on the other hand, to unsteadiness of flow in some wind tunnels. The wind tunnel method of experiment requires primarily a current of air which is steady in velocity both in time and across a section of the tunnel. It permits a leisurely study of the forces and couples produced by the wind on the model. Steadiness of flow of air and an aerodynamical balance is well adapted to measure with precision the forces and couples on a model in any position. The results are applicable to full scale aircraft.

"The Institute wind tunnel is housed in a shed 20 x 25 x 66 feet in size. The tunnel is 16 feet square in section and 53 feet in length. Air is drawn through an entrance nozzle and through the square tunnel by a four-bladed propeller, driven by a 10-horse-power motor. Models under test are mounted in the center of the square trunk on a vertical arm. The air passes through a honeycomb made up of a nest of three-inch metal conduit pipes, two feet, six inches in length. The honeycomb has effect in straightening the flow and preventing swirl of air. The air is then drawn past a star-shaped longitudinal baffle into an expanding cone, with a maximum wind flow up to 40 miles per hour. The cone expands in length of 11 feet to a cylinder of seven feet diameter, the expansion reducing velocity to raise static pressure of air. The large fan discharges into the room thereby reducing velocity of discharge and keeping down the turbulence of wake. Left to itself, the speed of the wind in the tunnel will vary some two per cent in two or three minutes. The cause is not understood. The gustiness of outdoor wind seems to have no effect."

Lack of Equipment in the Farm Kitchen

(*Continued from page 122*)

farm home is that we have been accustomed to look upon the water system, the lighting system, the vacuum cleaner, the cream separator, etc., as luxuries. They are not so, rather must we now consider them as necessities. How true it is that the luxuries of one generation become necessities of the next. The writer believes that $15 spent for a bath tub will yield its cash return just as certainly as money spent for the manure spreader, the hay sling, or the bobsled. Any improvement that economically increases the efficiency of the home is justifiable. The kitchen sink, the running water, the furnace, the

improved washer, the electric iron, the sweeper, the cream separator, the power churn, all are time savers and when intelligently installed and used enable the wife and mother to devote her time and energy to other things.

Then, too, how much these things add to the dignity of the home, to the self-respect of the family. And such things are real factors in the money-making capacity of any farm plant. As a people, farmers have been lacking in self-respect. How many times is the statement made, "Oh, I am only a farmer," seemingly an apology for the profession. Few people are better than they believe themselves to be. If money spent for modern equipment for the home will increase our respect for ourselves then the investment will be a profitable one.

Battleship Guns on the Western Front

(*Continued from page 123*)

left St. Nazaire on September 12th, 13th, and 14th. After a short stay at the A. E. F. reserve artillery base at Haussimont, these guns proceeded to Thierville, near Verdun, and opened fire on Longuyon and Montmedy to interrupt the German main rail line of communications between Metz and Sedan. This railroad had long been immune from the fire of the Allied armies, as it had been, up to that time, well beyond the range of their guns. It lay at a distance of about 40,000 yards, 22 miles, behind the enemy lines, and was the only line available for troop transportation other than a line running far to the north, through Luxemburg. This line was an easy target for the 14-inch naval rifles, and so at Verdun, as at Laon, the accurate and destructive fire of these guns created havoc in the German lines. Troop movement along the Metz-Sedan line was seriously impeded, a single hit from one of these guns completely destroying three railroad tracks for a distance of over 150 feet, leaving nothing but a deep shell hole to mark the spot. Within a month after these great guns began their bombardment, at this point, the American Army pushed forward and definitely cut the enemy's line of communication.

The last shot from the batteries was fired by Gun No. 4 at Thierville, near Verdun, at 10.59 A. M. on the morning of November 11th, 1918. By a curious coincidence, the headquarters train carrying General Foch and the Allied Staff, which met the German envoys, awaited the Germans on the identical siding near Compiegne from which the Naval Railway Batteries had fired their first shots just two months and five days previous.

Whatever the other accomplishments of our Navy and our Army in the great struggle just passed, history cannot fail to accord a place of prominence to the Naval Railway Batteries. Rear-Admiral C. P. Plunkett, U. S. Navy, who commanded the expedition, can well be proud of its achievements. The Naval Railway Batteries were the only strictly American guns in the war, and were also the most accurate and the longest ranged, of *all* the mobile guns of the armies engaged in the war.

Wood Ash as a Polish

SOMEONE has pointed out that the consumption of wood as fuel is attended with a by-product which has excellent polishing qualities. The writer recommends wood ash for polishing steel, pewter, brass, and copper in this way: That soft white, flaky ash is, as our careful grandmothers well knew, the best thing in the world as a cleaner and polisher. It will make the poor neglected fender shine like silver, put the wonted polish on the dulled luster of the brass candlesticks, fetch the soot off your enamel and aluminum kettles and pans, and clean them inside as well, without any of that unpleasant oily odor remaining behind which so many cleaning preparations leave in their wake. And—best of all—it costs nothing!—a receipt worth trying.

Recent Patent Decisions

(*Continued from page 126*)

and not technically a privy thereto, although allied in interest with defendant, is not bound by a decree affirming the validity of the patent alleged to have been infringed. Defendant, who admitted infringement of a patent, otherwise invalid, and defended on the ground of public prior use, has the burden of establishing such use beyond a reasonable doubt.—*Taigman v. Desure et al. U. S. C. C. A. of N. Y.*

First Inventor.—The original and first inventor is he who had not only first originated the novel concept, but who through the exercise of reasonable diligence has reduced it to practice—for a mere concept, not reduced to practice, is not patentable. A device need not be perfect in order to escape the charge of inoperativeness, and in case of a pioneer patent no one can expect the operative character of the device to respond to the highest test of perfection.—*Hildreth v. Mastoras. 253 Fed. 68.*

Combination of Elements.—The mere fact that human agency intervenes in an operation does not render a combination unpatentable, nor is it necessary that the action of the elements be simultaneous, nor that one of the elements shall so enter into the combination as to change the action of the others—but it is sufficient if there be some joint operation of the elements producing a result due to their coöperative action. To constitute a patentable combination, the result itself need not be new, but it is sufficient if an old result be produced in a more facile, economical, or efficient way.—*Willard v. Union Tool Co. 253 Fed. 48.*

Novelty vs. Mere Enlargement.—While one who, by enlarging size of patented article, makes it suitable for new use, is not entitled to patent, yet, where inventor combines new element with old device, whereby new and useful result is obtained, there is invention, which is patentable.—*Liquid Carbonic Co. v. Gilchrist Co. 253 Fed. 54.*

Patent and Infringement of Minor Improvements.—Claims in patents for minor improvements in an art already well understood should be strictly construed. The omission of one element of a claim to a patent averts infringement.—*Waterbury Farrel Fdy. & Mch. Co. v. E. J. Manville Mch. Co. U. S. D. C. of Conn.*

Narrow Claims.—Patent for a mold for making rubber heels, claim of which specified a mold chamber having one wall convex and the other concave, held invalid, and further held not infringed, if deemed limited to the particular structure shown and described in the patent.—*I. T. S. Rubber Co. v. Panther Rubber Mfg. Co. U. S. D. C. of Mass.*

A "Pioneer Patent" is one which meets an old or plainly recognized want by an entirely new method of approach. A machine patent, to be broad enough to cover every method of approaching a desired result, must be basic or pioneer, in such a way as to monopolize, not only the particular method but any method making use of equivalents. A patentee cannot claim as invention a combination that has nothing to do with the purposes of the device, unless he uses clear language making the extraneous combination applicable.—*F. N. Burt Co. v. W. S. Ritchey & Co. U. S. D. C. of N. Y.*

Identity of Design.—Sameness of appearance to the eye of an ordinary observer, not mere difference of lines or slight variation in configuration, is the test that determines identity of design on the question of infringement. Where, in infringement suit, prior use is sought to established by oral testimony only, the proof sustaining it must be clear and beyond a reasonable doubt.—*Inflexible Co. v. Megidow. U. S. D. C. of N. J.*

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NEW BOOKS, ETC.

UNIFIED MATHEMATICS. By Karpinski, Benedict and Calhoun. New York: D. C. Heath & Co., 1918. 8vo.; 522 pp.; illustrated.

Another effort to combine into a single course the work of trigonometry, college algebra and analytic geometry. In order of topics as satisfactory as any of the books which have developed this, as yet, uncrystallized idea. In choice of illustrative and problem material an extraordinarily live and practical volume. As a work of reference or an aid to the teacher who is giving such a course from another text or without printed text this book should be invaluable. As a text placed in the hands of the student our judgment is that it will hardly succeed. The authors, in their discussions and explanations, make simple things difficult by multiplication of words; and they display a positive genius for the construction of long and rambling sentences involving enough ideas for any self-respecting paragraph.

A TEXTBOOK IN GENERAL SCIENCE AND THE ECONOMICS OF DAILY LIFE. By Herbert Brownell, B.Sc. Philadelphia: P. Blakiston's Son and Co., 1918. 8vo. 383 pp.; illustrated. Price, $1 net.

This is a beginners' text, and a very good one. Among features that will commend it to thoughtful teachers are its insistent sharp distinction between theory and fact, and its emphasis on the limitations of theories, in school or out; its handling of explanations relating to the common phenomena of life; and its success in fostering the scientific spirit. The student is brought into that frame of mind which demands the facts, discriminates in their relative importance, and associates them in such manner as to get a concept of their relationship to other facts.

DISPENSARIES. THEIR MANAGEMENT AND DEVELOPMENT. By Michael M. Davis, Jr., Ph.D. and Andrew R. Warner, M.D. New York: The Macmillan Company, 1918. 8vo.; 438 pp.; illustrated. Price, $2.25.

In 1696, after the great fire of London, there was established in that city the first dispensary; their history in the United States began in Philadelphia nearly a century later. The work in hand gives a succinct history of their growth; it presents such practical details as all workers in dispensaries need to know, and demonstrates that the institution not only renders efficient medical service to the people, but also benefits the medical profession by stabilizing the economic position of the average physician. Technique, special types, and public problems are scrutinized, and it is to be hoped that the book may contribute toward a better understanding and greater cooperation between the public, the physician, and the institution which helps 4,000,000 of our population every year.

HOW TO MAKE JEWELRY. By George S. Overton. Providence, R. I.: Walter B. Frost and Company, 42 Weybosset Street. 8vo.; 232 pp.; illustrated. Price, $1.50.

These collected papers by a manufacturing jeweler, first printed in a trade periodical, contain much exact information as to processes and problems that it would be exceedingly difficult to find elsewhere. The technique here divulged is of value not only to the beginner, but equally to the manufacturer of experience. Representative chapters are on designing, alloying of gold, wire drawing and working, soldering and stone setting, color work, silver plating and silver finishes, enameling, working in platinum, shop costs and the reduction of time and labor, the buying of stones, and the making of all kinds of jewelry and novelties, with practical hints for working jewelers.

POPULAR OIL GEOLOGY. By Victor Ziegler, Professor of Geology and Mineralogy, Colorado School of Mines. New York: John Wiley and Sons, Inc., 1918. 8vo.; 158 pp.; illustrated. Price, $2.50.

This work sketches the rise and development of the petroleum industry, studies the properties and composition of oil and gas and their origin, treats of rocks, their properties, arrangements and structures, and the laws of migration and accumulation, and discusses maps and their uses, oil structures and oil fields, and the prospecting and development of oil lands are set forth in a popular way, and some persistent fallacies are exploded. The chapter on oil shales and their utilization is timely, and the concluding advice on oil investments should be assimilated by all investors.

THE GUN BOOK. For Boys and Men. By Thomas Heron McKee. New York: Henry Holt and Company, 1918. 8vo.; 362 pp.; illustrated. Price, $1.60 net.

History, anecdote and practical information succeed one another in this absorbing work, and the "boys of all ages" to whom it is addressed may read of the blacksmith-made guns of olden days and follow gun development down the years to the rifles and machine guns of the world war. It is easy reading, yet satisfies the universal demand to know "just how it works." The abundant illustrations add greatly to what is really the only popular yet comprehensive book on its subject.

THE STORY OF THE SUN. By Frank M. O'Brien. With an Introduction by Edward Page Mitchell, Editor of *The Sun*. New York: George H. Doran Company, 1918. 8vo.; 454 pp.; illustrated. Price, $3 net.

The story of a great newspaper is the story of a mighty influence that has kept in close touch with human affairs and molded men's opinions. *The Sun* has reflected and reacted upon our political and social fabric since the days when New York was no bigger than Seattle is today; from, in short, "the days of duels, of Davy Crockett, of pigs wandering in City Hall Park." From Dana down, it has been shaped by, and has in turn shaped, many famous Americans. Its full story is here told with a wealth of color and a sustained interest that will win it many readers.

READINGS IN THE ECONOMICS OF WAR. Edited by J. Maurice Clark, Walton H. Hamilton and Harold G. Moulton. Chicago: The University of Chicago Press, 1918. 8vo.; 700 pp.; illustrated. Price, $3 net.

Before this many-sided subject may be properly surveyed and the significance of its various aspects grasped, it must be intelligently sketched from many angles. The three main divisions of this work deal with the economic background of war, war as a business venture, and the nature of modern war. The pros and cons are debated by such antagonists as Woodrow Wilson, F. von Bernhardi, David Lloyd George and a host of lesser lights. The result is a most comprehensive and enlightening study of the causes, accompaniments and aftermaths of war, with a serious consideration of the economic factors in an enduring peace. The problems of demobilization and reconstruction are presented, together with some of the programs of social reform.

AEROPLANES AND AERO ENGINES. By "Avion." Philadelphia: J. B. Lippincott Company, 1918. 12mo.; 158 pp.; illustrated. Price, $1 net.

This manual is avowedly written for the man in the street; it forms an introduction to the study of flight, and aims at giving its readers a superficial insight into aviation problems that will enable them to inspect an aeroplane or visit an aero exhibition with greater enjoyment and profit.

JEWELRY MAKING AND DESIGN. An Illustrated Text Book for Teachers, Students of Design, and Craft Workers in Jewelry. By Augustus F. Rose and Antonio Cirino, B.S. Providence, R. I.: Metal Crafts Publishing Co. 8vo.; 475 pp.; profusely illustrated; 13 colored plates. Price, $5 net.

The result of fifteen years of successful teaching, this beautiful volume is no less practical than inspiring. Lovers of the design with an individuality will find a wealth of suggestion in its pages, with their hundreds of pieces of finished jewelry. Craft workers may follow every operation from start to finish, for all details are specifically and completely handled. The first section, on jewelry making, deals with stones and their cutting, with gold and silver, and the processes involved; brooches, scarf pins, pendants and rings are created from various materials, and enameling, modeling and casting explained. The second section, treating of design, includes historic ornament, motifs from nature, the choice of material, drawing, equipment, and many other considerations vital to this branch of the subject. The work is destined to be a source of much pleasure and profit.

THE AMERICAN RIFLE. A Treatise, a Text Book, and a Book of Practical Instruction in the Use of the Rifle. By Major Townsend Whelen, U. S. A. New York: The Century Company, 1918. 8vo.; 640 pp.; over 350 illustrations. Price, $5.

Major Whelen, a recognized authority on small arms, comes to his task with 25 years of experience and an unbounded enthusiasm. He has not made this a war book; he prefers rather to dwell lovingly upon that red-blooded pioneer period when the indispensables of equipment were the axe and the rifle; the outdoor, shooting man is his ideal American. Yet the scope of the work, bringing it down to the present, of necessity includes much modern practice of the very highest value to the soldier. The results and conclusions of the author's many experiments are found here, and the work bids fair to become a standard text and reference. Part I. contains historical and introductory material and deals with construction and ballistics. Part II. covers practical rifle shooting from every point of view, in sport, in wilderness life, and in war.

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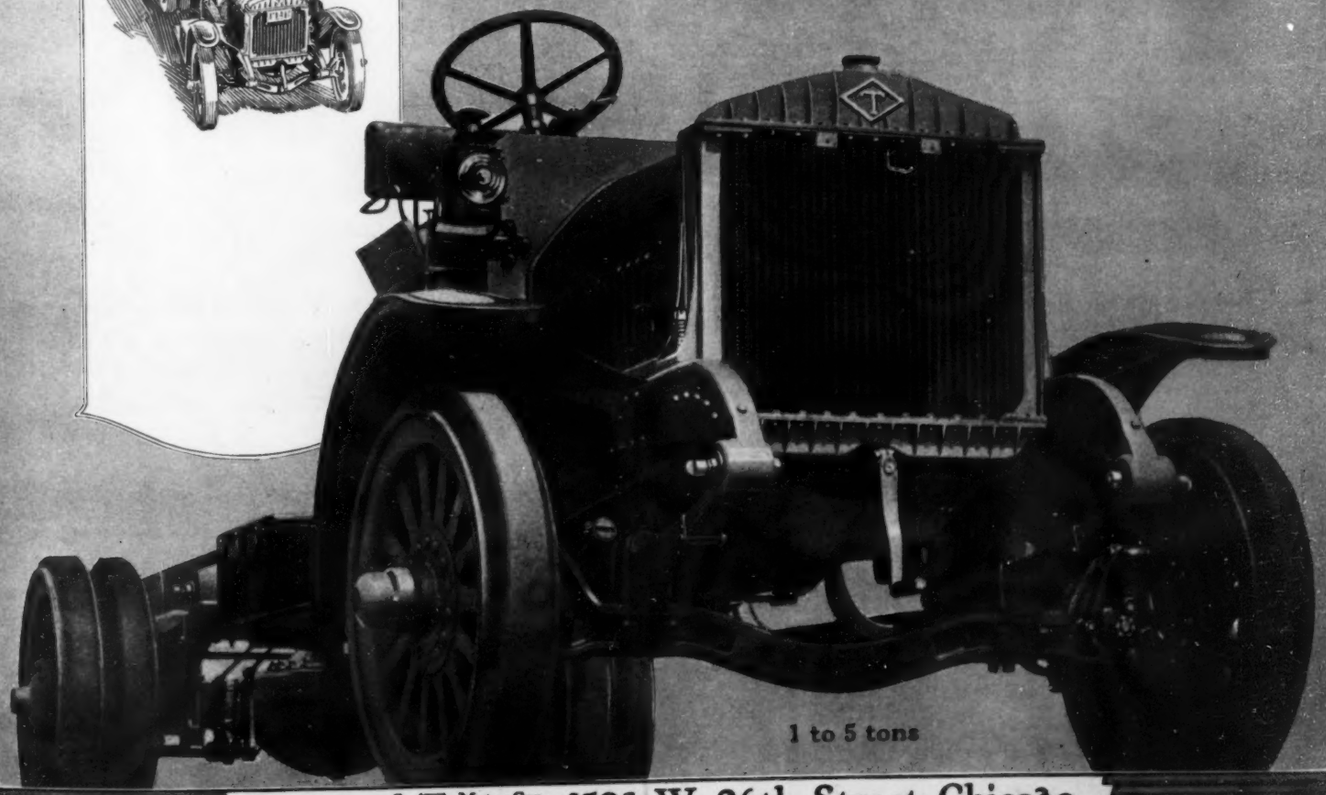

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